http://dx.doi.org/10.5935/0103-5053.20140023

J. Braz. Chem. Soc., Vol. 25, No. 4, 704-708, 2014.
Printed in Brazil - ©2014 Sociedade Brasileira de Química
0103 - 5053 $6.00+0.00

Article

A New Flavonoid Derivative from Leaves of *Oxandra sessiliflora* R. E. Fries

Elcilene A. de Sousa,[a] Armenio A. C. A. da Silva,[a] Alberto J. Cavalheiro,[b] João Henrique G. Lago[c] and Mariana H. Chaves*,[a]

[a]*Departamento de Química, Universidade Federal do Piauí, 64049-550 Teresina-PI, Brazil*

[b]*Instituto de Química, Universidade Estadual Paulista, CP 355, 14800-900 Araraquara-SP, Brazil*

[c]*Instituto de Ciências Ambientais, Químicas e Farmacêuticas, Universidade Federal de São Paulo, 09972-270 Diadema-SP, Brazil*

A fração em acetato de etila (EtOAc) obtida a partir da partição do extrato de etanol (EtOH) das folhas de *O. sessiliflora* R. E. Fries (Annonaceae) foi submetida a diversos procedimentos cromatográficos, incluindo cromatografia líquida de alta eficiência (HPLC), o que resultou no isolamento dos flavonóides: quercetina-3-O-α-L-ramnopiranosil-(1→4)-β-D-glucopiranosídeo (**1**), inédito na literatura, canferol-3-O-α-L-ramnopiranosil-(1→4)-β-D-glucopiranosídeo (**2**), rutina (**3**) e canferol-3-O-rutinosídeo (**4**). As estruturas foram definidas através da análise dos espectros de ressonância magnética nuclear (NMR) de ^{1}H e de ^{13}C (1D e 2D) e espectrometria de massas.

The ethyl acetate (EtOAc) phase obtained from the partition of the ethanol (EtOH) extract from leaves of *O. sessiliflora* R. E. Fries (Annonaceae) was subjected to several chromatographic steps, including high efficiency liquid chromatography (HPLC), to afford the flavonoids: quercetin-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside (**1**), unprecedented in the literature, kaempferol-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside (**2**), rutin (**3**), and kaempferol-3-O-rutinoside (**4**). The structures were elucidated by analysis of their ^{1}H and ^{13}C nuclear magnetic resonance (NMR) (1D and 2D) spectra and mass spectrometry.

Keywords: *Oxandra sessiliflora,* flavonoids, quercetin-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside

Introduction

The genus *Oxandra* (Annonaceae) consists of about 22 species, 14 of these being found in Brazil and distributed in North, Northeast, Midwest and Southeast regions.[1,2] This genus has native origin and phytogeographic domains in the Amazon, Caatinga, Cerrado, and Atlantic Forest.[3] There are few articles reporting the chemical composition and pharmacological activity of plants of the genus *Oxandra*. Alkaloids, triterpenes, monoterpenes, and steroids with anti-inflammatory and antioxidant activities were isolated from *O. xylopioides*,[4-12] while trypanocidal and antileishmanial monoterpenes have been reported from *O. espintana*.[13] Additionally, alkaloids, sesquiterpenes and triterpenes have been isolated from *O. asbeckii*.[14]

Oxandra sessiliflora R. E. Fries, popularly known as "conduru-preto",[3,15,16] is a species endemic to Brazil in which only the chemical composition of essential oil from leaves have previously been reported in the literature.[17] In continuation with our studies on *O. sessiliflora*, the present work describes the isolation and characterization of four flavonoids from ethyl acetate (EtOAc) phase from ethanol (EtOH) extract from leaves: quercetin-3-O-β-D-glucopyranosyl-(1→4)-α-L-rhamnopyranoside (**1**), kaempferol-3-O-β-D-glucopyranosyl-(1→4)-α-L-rhamnopyranoside (**2**), quercetin-3-O-β-D-glucopyranosyl-(1→6)-α-L-rhamnopyranoside (rutin, **3**), and kaempferol-3-O-β-D-glucopyranosyl-(1→6)-α-L-rhamnopyranoside (**4**). The structures of the isolated compounds were established based on the analysis of their ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectra, including HMQC, HMBC and COSY experiments, and comparison with literature data. This is the first occurrence of flavonoid **1** and assignment of ^{13}C NMR data of flavonoid **2**.

*e-mail: mariana@ufpi.edu.br

Results and Discussion

The EtOH extract of the leaves of *O. sessiliflora* was partitioned between MeOH:H_2O 2:1 and hexane, CH_2Cl_2 and EtOAc successively. The EtOAc fraction was subjected to column chromatography on reverse phase (C_{18}) and Sephadex LH-20, followed by purification of the obtained fractions by high performance liquid chromatography (HPLC) to afford compounds 1-4 (Figure 1).

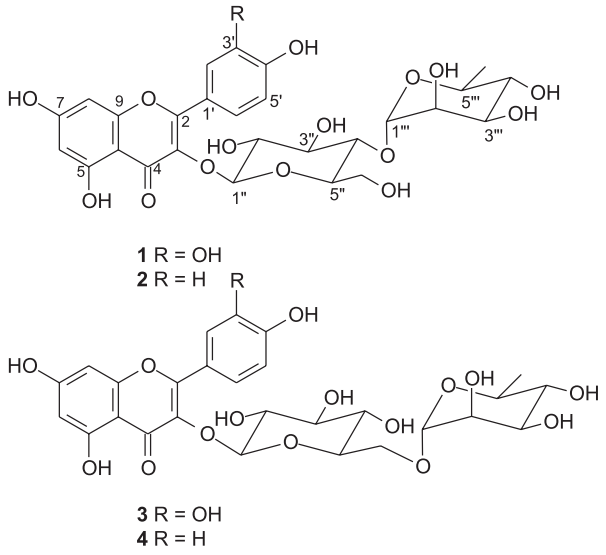

Figure 1. Structures of isolated flavonoids from *Oxandra sessiliflora* R. E. Fries.

The ^{1}H NMR spectrum of compound **1** showed five signals in the aromatic hydrogen region, consistent with the replacement pattern of the flavonol quercetin: two broad singlets at δ_H 6.21/6.40, assigned to H-6/H-8, two doublets at δ_H 6.88 (d, 1H, *J* 8.0 Hz, H-5') and 7.58 (d, 1H, *J* 8.0 Hz, H-6') as well as one broad singlet at δ_H 7.71, assigned to H-2'. This spectrum displayed also signals at δ_H 3.20-3.72 (H-2''-H-6''), which in association to the presence of one doublet at δ_H 5.24 (d, 1H, *J* 7.5 Hz, H-1''), assigned to the anomeric hydrogen *trans*-diaxial position with H-2, characterize the β-D-glucoside unit. In this spectrum was also observed a broad singlet at δ_H 5.22 (H-1''') assigned to an anomeric di-equatorial hydrogen, which, associated to the doublet at δ_H 1.25 (d, 3H, *J* 6.0 Hz, H-6''') suggests the presence of α-L-rhamnose.[18]

The negative HRESIMS of **1** revealed a pseudo-molecular ion at *m/z* 609.1411 $[M-H]^-$, consistent with the molecular formula $C_{27}H_{30}O_{16}$. ^{13}C NMR spectra, including DEPT 90° and 135°, displayed 27 carbon signals being one methyl, one methylene, 15 methyne and 10 non-hydrogenated carbons. Oxymethine carbon signals ranging from δ_C 84 to 69, mainly those at δ_C 62.5 (C-6''), 17.9 (C-6'''), 102.7 (C-1''') and 104.3 (C-1''), confirmed the presence of glucose and rhamnose in the molecule of **1**.[18,19]

Hydrogen signals of each sugar unit were assigned by analysis of the 1D TOCSY spectrum. Irradiation of the anomeric hydrogen from rhamnose (δ_H 5.22, H-1''') allowed the attribution of signals at δ_H 3.99 (H-2''/H-5'''), 3.72 (H-3'''), 3.41 (H-4''') and 1.25 (H-6''') to rhamnose unit and those at δ_H 3.59 (H-2''/ H-4''/ H-6''a), 3.25 (H-3''), 3.41 (H-5''), and 3.72 (H-6'' b) to glucose unit (Table 1). HMQC, HMBC and DQF-COSY spectra displayed important correlations between hydrogens and carbons of **1** (Figure 2), mainly that of H-1'' (δ_H 5.24) with C-3 (δ_C 135.6), which showed that glucose is linked to the aglycone at C-3, and that of H-1''' (δ_H 5.22) with C-4'' (δ_C 84.4), which indicated that rhamnose is linked at C-4 of glucose. Therefore, analysis of the obtained data was consistent with the new structure quercetin-3-O-β-D-glucopyranosyl-(1→4)-α-L-rhamnopyranoside (**1**).

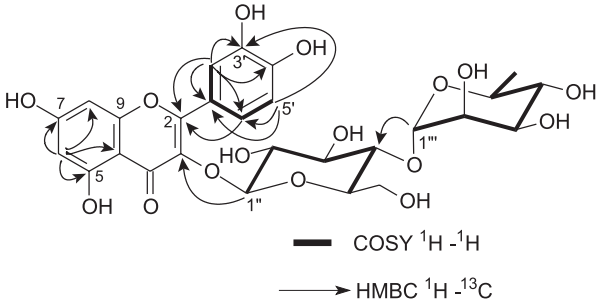

Figure 2. HMBC and COSY correlations in the structure of **1**.

The ^{1}H NMR spectrum of **2** showed similarities to that recorded to flavonoid **1**, with two broad singlets at δ_H 6.19/6.38, assigned to H-6/H-8 of ring A. This spectrum displayed also signals at range from δ_H 3.20 to 5.21 (oxymethine hydrogens) and one doublet at δ_H 1.24 (*J* = 6.0 Hz), suggesting the presence of rhamnose in the molecule. The signals superimposed at δ_H 5.21 (2H) have been assigned to the anomeric protons H-1'' and H-1'''. The main observed difference in the ^{1}H NMR spectrum of **2** is associated to the substitution pattern of kaempferol (1,4-disubstituted B ring), due to the presence of two doublets at δ_H 6.88 and 8.03 (d, *J* = 8.0 Hz) integrated to two hydrogens each and thus assigned to H-3'/H-5' and H-2'/H-6', respectively. ^{13}C NMR spectra of **2**, including DEPT 90° and 135°, showed one carbonyl carbon signal at δ_C 179.4 (C-4) and aromatic carbon signals at range δ_C 166-95, to confirm the kaempferol aglycone moiety. Oxygenated carbons at range δ_C 84-70, mainly methylene carbons and methyl at δ_C 62.5 (C-6'') and 17.9 (C-6'''), respectively, as well as anomeric carbons at δ_C 104.2 (C-1'')

Table 1. NMR data of compounds **1** and **2** (500 MHz and 125 MHz, δ in ppm, J in Hz, CD_3OD)

C	**1**					**2**
	δ_c	δ_H	HMBC		COSY	δ_c
			$^2J_{CH}$	$^3J_{CH}$	^{1}H-^{1}H	
2	158.5	–	–	H-2', H-6'	–	158.4
3	135.6	–	–	H-1''	–	135.5
4	179.5	–	–	–	–	179.4
5	163.0	–	H-6	–	–	162.9
6	100.0	6.21 (br s)	–	–	–	100.0
7	166.1	–	H-6	–	–	166.1
8	94.8	6.40 (br s)	–	H-6	–	94.8
9	159.0	–	–	–	–	159.4
10	105.6	–	–	H-6	–	105.6
1'	123.0	–	H-2'	H-5'	–	122.7
2'	117.6	7.71 (br s)	–	H-6'	–	132.3
3'	145.9	–	H-2'	H-5'	–	116.1
4'	149.9	–	–	H-2', H-6'	–	161.6
5'	116.0	6.88 (d, *J* 8.0)	H-6'	–	H-6'	116.1
6'	123.2	7.58 (d, *J* 8.0)	H-5'	H-2'	H-2', H-5'	132.3
Glucose[a]						
1''	104.3	5.24 (d, *J* 7.5)	H-2''	–	H-2''	104.2
2''	76.2	3.59 (m)	–	H-4''	H-3''	76.2
3''	78.3	3.25 (m)	–	H-5''	H-4''	78.2
4''	84.4	3.59 (m)	H-5''	H-2'', H-6'', H-1'''	H-5''	84.3
5''	69.8	3.41 (m)	H-5''	H-3'', H-1''	H-4''	69.9
6''	62.5	3.59/3.72 (m)	–	–	–	62.5
Rhamnose[a]						
1'''	102.7	5.22 (s)	–	H-4''	H-2'''	102.7
2'''	72.3	3.99 (m)	–	H-4'''	H-3'''	72.3
3'''	72.3	3.72 (m)	H-2'''	H-5'''	H-4'''	72.3
4'''	74.0	3.41 (m)	H-3''', H-5'''	H-2'''	H-5'''	74.0
5'''	70.1	3.99 (m)	H-4'''	H-1'''	H-6'''	70.1
6'''	17.9	1.25 (d, *J* 6.0)	–	H-4'''	H-5'''	17.9

[a]Assignments were based in analysis of TOCSY 1D NMR spectra.

and 102.7 (C-1'''), confirming the presence of glucose and rhamnose. These information, associated with literature data for flavonoids with the same aglycone,[19] allowed the identification of **2** as kaempferol-3-O-β-D-glucopyranosyl-(1→4)-α-L-rhamnopyranoside, previously isolated from *Acacia pennata* Willd (Mimosaceae).[20] However, this is the first occurrence in Annonaceae family and the first description of its assigned ^{13}C NMR data.

The structures of flavonoids **3** and **4** were identified by analysis of ^{1}H and ^{13}C NMR as well as HRESIMS and comparison with data described in the literature.[18,19]

Conclusion

This study contributed to the expansion of the chemical constituents of the *Oxandra* genus since the compound kaempferol-3-O-β-D-glucopyranosyl-(1→4)-α-L-rhamnopyranoside (**2**) is being described for the first time in Annonaceae while quercetin-3-O-β-D-glucopyranosyl-(1→4)-α-L-rhamnopyranoside (**1**) is a new compound.

Experimental

General procedures

^{1}H and ^{13}C NMR spectra were obtained on Varian spectrometer-model INOVA, operating at 500 MHz for ^{1}H and 125 MHz for ^{13}C using CD_3OD as a solvent and tetramethylsilane (TMS) as internal reference. HRESIMS spectrum (negative mode) was recorded on a Bruker Daltonics UltrOTOFq-ESI-TOF spectrometer. Silica gel (70-230 mesh, Merck) and Sephadex LH-20 (Amersham Biosciences) were used for column chromatography (CC), whereas silica gel 60 GF_{254} was employed for analytical

thin layer chromatography (TLC) (0.50 mm). HPLC analyses were performed on Varian Pro Star with ternary system pumps Model 240, UV-Vis Diode Array Detector (DAD) model 330 and injector model 410 (analytical), and Varian Star Model Prep SD-1 with UV-Vis detector model 320, manual injector Rheodyne model 7725i with sample loop of 2.5 mL (preparative). Phenomenex Gemini C-18 columns (250 × 4.6 mm, 5 μm and 250 × 21 mm, 10 μm) were used to these analyses. Solvents and reagents used were of analytical purity grade and HPLC.

Plant material

The leaves of *O. sessiliflora* were collected in the Environmental Park of Teresina-PI, in June 2009. The species was identified by Professor Roseli Farias Melo Barros and a voucher specimen with number TEPB 27870 was deposited in the Herbarium Graziela Barroso do Amaral (UFPI).

Extraction and isolation

The leaves of *O. sessiliflora* were dried at room temperature and then grinded. The obtained material (779 g) was subjected to exhaustive maceration with EtOH at room temperature. After concentration on reduced pressure, 109 g of EtOH extract were obtained (14%). Part of the EtOH extract (86 g) was suspended in MeOH-H_2O (2:1) and extracted with hexane, CH_2Cl_2 and EtOAc successively to afford 21 g (24%), 30 g (35%) and 14 g (17%) of organic phases, respectively.

Part of the EtOAc phase (3.5 g) was suspended in 10 mL of H_2O-MeOH 1:1 and the soluble portion was applied in a Stracta column (C_{18}, 10 g), which was eluted with MeOH:H_2O 1:1, MeOH and chloroform ($CHCl_3$) successively. The fraction eluted with MeOH-H_2O 1:1 (FA1; 1380 mg) was chromatographed on Sephadex LH-20 eluted with MeOH to afford 5 groups (A-E). Group D (345 mg) was analyzed by reverse phase HPLC-UV DAD eluted with exploratory gradient H_2O + 0.2% AcOH-MeOH (5% → 100%; 200-600 nm, 1 mL min^{-1}; 50 min) and then subject to a isocratic elution mode. The improved separation of the constituents was achieved with the mobile phase (MeOH-ACN 1:1) / (H_2O + 0.2% AcOH) (3:7), resulting in the isolation of flavonoids **1** (20 mg), **2** (21 mg) **3** (11 mg) and **4** (8 mg).

Quercetin-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside (**1**)

Yellow amorphous solid; HRESIMS: 609.1411 $[M-H]^-$ (calculated to $C_{27}H_{29}O_{16}$: 609.1455); NMR data: see Table 1.

Kaempferol-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside (**2**)

Yellow amorphous solid; ^1H NMR (CD_3OD, 500 MHz) δ 6.19 (br s, H-6), 6.38 (br s, H-8), 8.03 (d, *J* 8.0 Hz, H-2'/H-6''), 6.88 (d, *J* 8.0 Hz, H-3'/H-5'), 5.21 (d, *J* 7.5 Hz, H-1''), 5.21 (br s, H-1'''), 1.24 (d, *J* 6.0 Hz, H-6'''), 3.20-4.00 (H-2'' to H-6'', H-2''' to H-5'''); ^{13}C NMR: see Table 1.

Quercetin 3-O-β-D-glycopyranosil-(6→1)-α-L-rhamnopyranoside (rutin, **3**)

Yellow amorphous solid; HRESIMS: 609.1616 $[M-H]^-$ (calculated to $C_{27}H_{29}O_{16}$: 609.1455) and 301.0851 [M-glucose unit]$^-$; ^1H NMR (CD_3OD, 500 MHz) δ 6.21 (d, *J* 2.0 Hz, H-6), 6.40 (d, *J* 2.0 Hz, H-8), 7.66 (d, *J* 2.0 Hz, H-2'), 6.86 (d, *J* 8.5 Hz, H-5'), 7.60 (dd, *J* 8.5 and 2.0 Hz, H-6'), 5.11 (d, *J* 7.5 Hz, H-1''), 4.52 (d, *J* 1.5 Hz, H1'''), 1.18 (d, *J* 6.0 Hz, H-6'''), 3.20-3.90 (H-2'' to H-6'', H-2''' to H-5'''); ^{13}C NMR (CD_3OD, 125 MHz) δ 158.5 (C-2), 135.9 (C-3), 179.5 (C-4), 163.0 (C-5), 100.0 (C-6), 166.1 (C-7), 94.9 (C-8), 159.0 (C-9), 105.6 (C-10), 123.0 (C-1'), 117.9 (C-2'), 145.8 (C-3'), 150.0 (C-4'), 116.1 (C-5'), 123.6 (C-6'), 104.7 (C-1''), 75.7 (C-2''), 77.2 (C-3''), 71.4 (C-4''), 78.2 (C-5''), 68.6 (C-6''), 102.4 (C-1'''), 72.1 (C-2'''), 72.3 (C-3'''), 73.1 (C-4'''), 69.7 (C-5'''), 18.0 (C-6''').

Kaempferol-3-O-rutinoside (**4**)

Yellow amorphous solid; HRESIMS: 593.1639, $[M-H]^-$ (calculated to $C_{27}H_{29}O_{15}$: 593.1506), 284.0652 [M-glucose unit]$^-$; ^1H NMR (CD_3OD, 500 MHz) δ 6.21 (br s, H-6), 6.40 (br s, H-8), 8.06 (d, *J* 9.0 Hz, H-2'/H-6'), 6.90 (d, *J* 9.0 Hz, H-3'/H5'), 5.11 (d, *J* 7.5 Hz, H-1''), 4.52 (br s, H-1'''), 1.12 (d, *J* 6.0 Hz, H-6'''), 3.27-3.80 (H-2'' to H-6'', H-2''' to H-5'''); ^{13}C NMR (CD_3OD, 125 MHz) δ 158.7 (C-2), 135.5 (C-3), 179.4 (C-4), 163.1 (C-5), 100.0 (C-6), 166.2 (C-7), 95.0 (C-8), 159.4 (C-9), 105.6 (C-10), 122.8 (C-1'), 132.4 (C-2'/C-6'), 116.2 (C-3'/C-5'), 161.5 (C-4'), 104.6 (C-1''), 76.8 (C-2''), 78.2 (C-3''), 71.5 (C-4''), 77.2 (C-5''), 68.6 (C-6''), 102.4 (C-1'''), 72.1 (C-2'''), 72.3 (C-3'''), 74.0 (C-4'''), 69.7 (C-5'''), 17.9 (C-6''').

Supplementary Information

Supplementary information (NMR and LRESIMS for compounds **1**-**4**) is available free of charge at http://jbcs.sbq.org.br as PDF file. (Figures S1 to S26).

Acknowledgments

The authors thank Prof Dr Roseli F. M. Barros (UFPI) for identifying the plant material and to CNPq and CAPES for scholarships and financial support.

References

1. Lobão, A. Q.; Araujo, D. S. D.; Kurtz, B. C.; *Rodriguésia* **2005**, *56*, 85.
2. Leboeuf, M.; Cavé, A.; Bhaumik, P. K.; Mukherjee, B.; Murkherjee, R.; *Phytochemistry* **1982**, *21*, 2783.
3. Forzza, R. C.; Leitman, P. M.; Costa, A. F.; Carvalho Jr, A. A.; Peixoto, A. L.; Walter, B. M. T.; Bicudo, C.; Zappi, D.; Costa, D. P.; Lleras, E.; Martinelli, G.; Lima, H. C.; Prado, J.; Stehmann, J. R.; Baumgratz, J. F. A.; Pirani, J. R.; Sylvestre, L. S.; Maia, L. C.; Lohmann, L. G.; Paganucci, L.; Silveira, M.; Nadruz, M.; Mamede, M. C. H.; Bastos, M. N. C.; Morim, M. P.; Barbosa, M. R.; Menezes, M.; Hopkins, M.; Secco, R.; Cavalcanti, T.; Souza, V. C. In *Catálogo de Plantas e Fungos do Brasil*; vol. 1, Jardim Botânico do Rio de Janeiro: Rio de Janeiro, 2010.
4. Rojano, B. A.; Gaviria, C. S. A.; Gil, M. A.; Saez, J. A.; Schinella, G.; Tournier, H.; *Vitae* **2008**, *15*, 173.
5. Rojano, B. A.; Gaviria, M.; Carlos, A.; Saez, V.; Jairo, A.; Yepes, F.; Munoz, F.; Ossa, F.; *Vitae* **2007**, *14*, 95.
6. Rojano, B.; Pérez, E.; Figadère, B.; Martin, M. T.; Recio, M. C.; Giner, R.; Rios, J. L.; Schinella, G.; Saez, J.; *J. Nat. Prod.* **2007**, *70*, 835.
7. Guinaudeau, H.; Leboeuf, M.; Cavé, A.; *J. Nat. Prod.* **1988**, *51*, 389.
8. Arango, G.; Cortes, D.; Cavé, A.; *Phytochemistry* **1987**, *26*, 1227.
9. Arango, G. J.; Cortes, D.; Cassels, B. K.; Cavé, A.; Merienne, C.; *Phytochemistry* **1987**, *26*, 2093.
10. Zhang, J.; El-Shabrawy, A. O.; El-Shanawany, M. A.; Schiff-Jr, P. L.; Slatkin, D.; *J. Nat. Prod.* **1987**, *50*, 800.
11. El-Shanawany, M. A.; *Bull. Pharmaceut. Sci.* **1985**, *8*, 127.
12. El-Shanawany, M. A.; Slatkin, D. J.; Schiff, P. L.; El-Shabrawy, A.; *Bull. Pharmaceut. Sci.* **1985**, *8*, 172.
13. Hocquemiller, R.; Cortes, D.; Arango, G. J.; Myint, S. H.; Cave, A.; *J. Nat. Prod.* **1991**, *54*, 445.
14. Tinto, W. F.; Blair, L. C.; Reynolds, W. F.; Mclean, S.; *J. Nat. Prod.* **1992**, *55*, 701.
15. Mesquita, M. R.; Castro, A. A. J. F.; *Publ. Avulsas Ciênc. Amb.* **2007**, *15*, 1.
16. Abreu, M. C.; Castro, A. A. J. F.; *Publ. Avulsas Ciênc. Amb.* **2004**, *9*, 1.
17. Silva, A. A. C. A.; Souza, E. A.; Matsuo, A. L.; Lago, J. H. G.; Chaves, M. H.; *J. Med. Plants Res.* **2013**, *7*, 504.
18. Guvenalp, Z.; Kiliç, N.; Kazaz, C.; Kaya, Y.; Demirezer, O.; *Turk. J. Chem.* **2006**, *30*, 515.
19. Agrawal, P. K.; *Carbon-13 NMR of Flavonoids*, Agrawal, P. K., ed.; Elsevier: Amsterdam, 1989.
20. Dongmo, A. B.; Milyamoto, T.; Yoshikawa, K.; Arihara, S.; Lacaille-Dubois, M.; *Planta Med.* **2007**, *73*, 1202.

Submitted on: September 24, 2013
Published online: January 31, 2014

FAPESP has sponsored the publication of this article.

J. Braz. Chem. Soc., Vol. 25, No. 4, S1-S13, 2014.
Printed in Brazil - ©2014 Sociedade Brasileira de Química
0103 - 5053 $6.00+0.00

Supplementary Information

A New Flavonoid Derivative from Leaves of *Oxandra sessiliflora* R. E. Fries

Elcilene A. de Sousa,[a] Armenio A. C. A. da Silva,[a] Alberto J. Cavalheiro,[b] João Henrique G. Lago[c] and Mariana H. Chaves*[,a]

[a]*Departamento de Química, Universidade Federal do Piauí, 64049-550 Teresina-PI, Brazil*

[b]*Instituto de Química, Universidade Estadual Paulista, CP 355, 14800-900 Araraquara-SP, Brazil*

[c]*Instituto de Ciências Ambientais, Químicas e Farmacêuticas, Universidade Federal de São Paulo, 09972-270 Diadema-SP, Brazil*

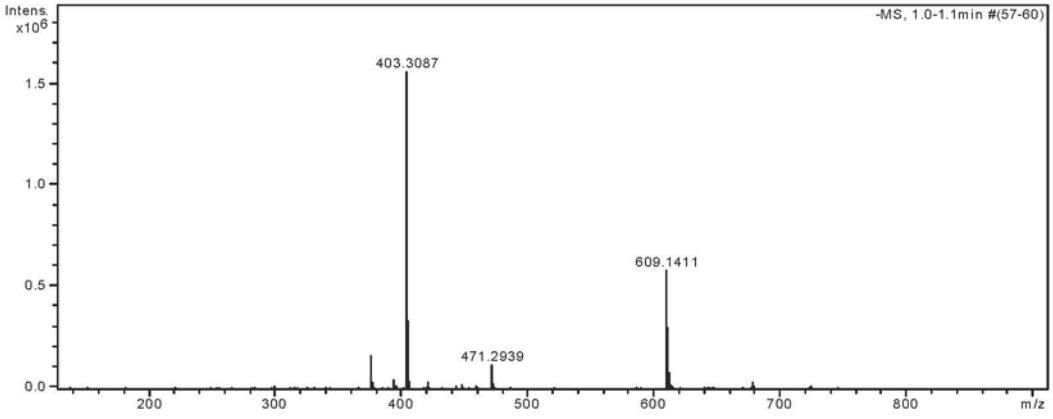

Figure S1. HRESIMS spectrum (negative mode) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

*e-mail: mariana@ufpi.edu.br

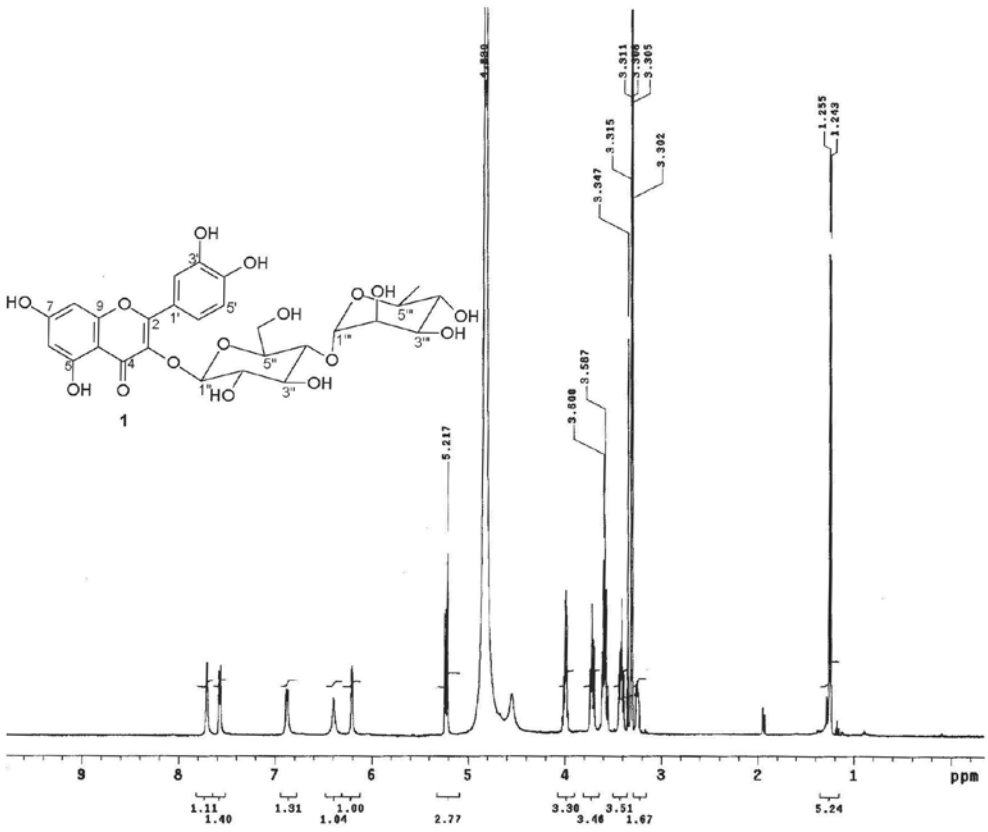

Figure S2. ^{1}H NMR spectrum (CD_3OD, 500 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

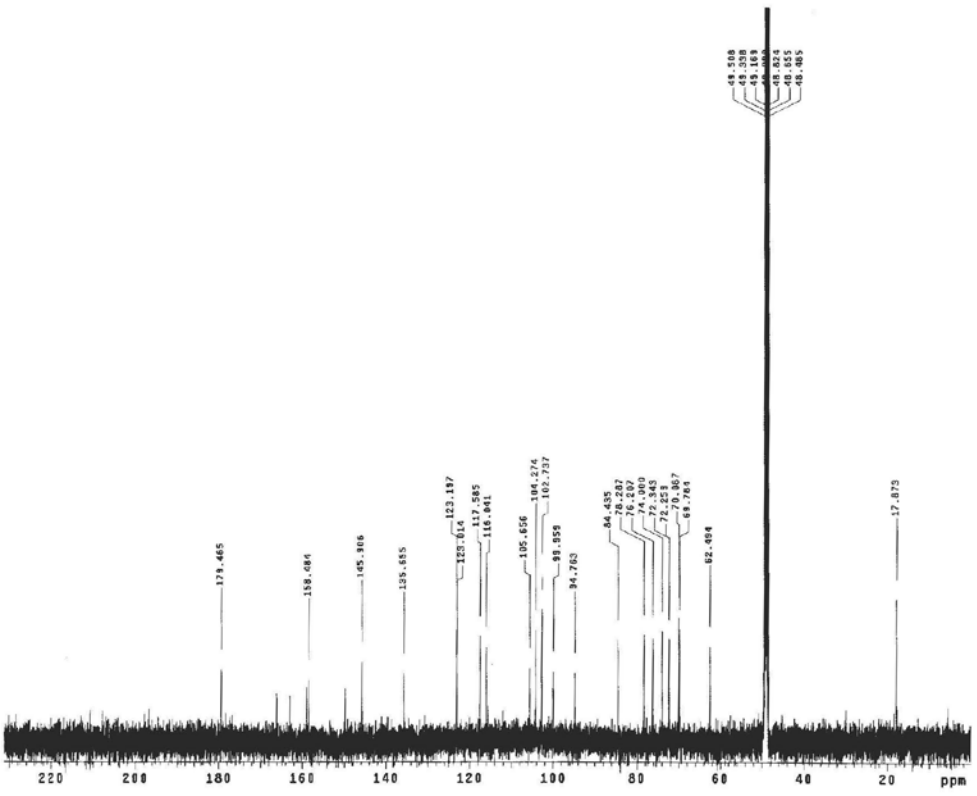

Figure S3. ^{13}C NMR spectrum (CD_3OD, 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

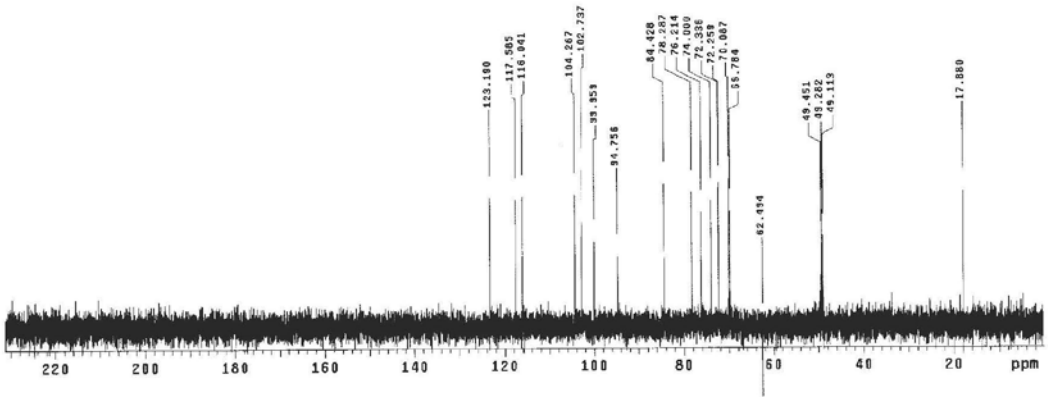

Figure S4. DEPT 135° NMR experiment (CD_3OD, 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

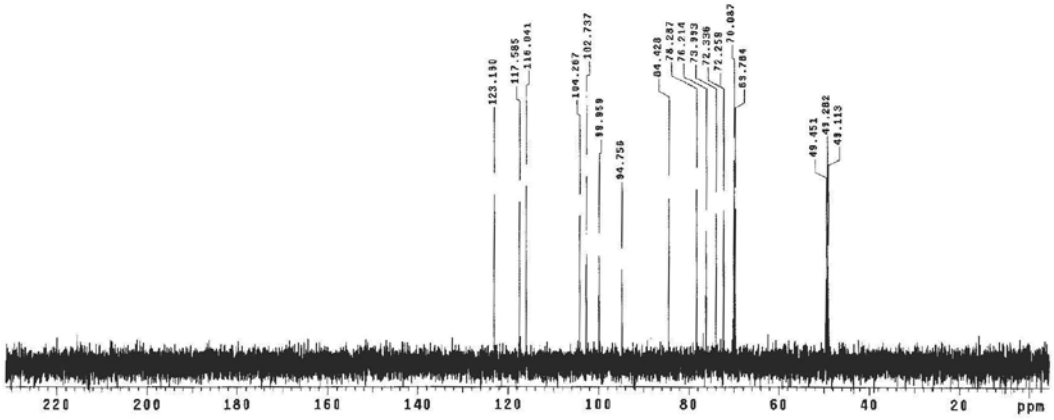

Figure S5. DEPT 90° NMR experiment (CD_3OD, 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

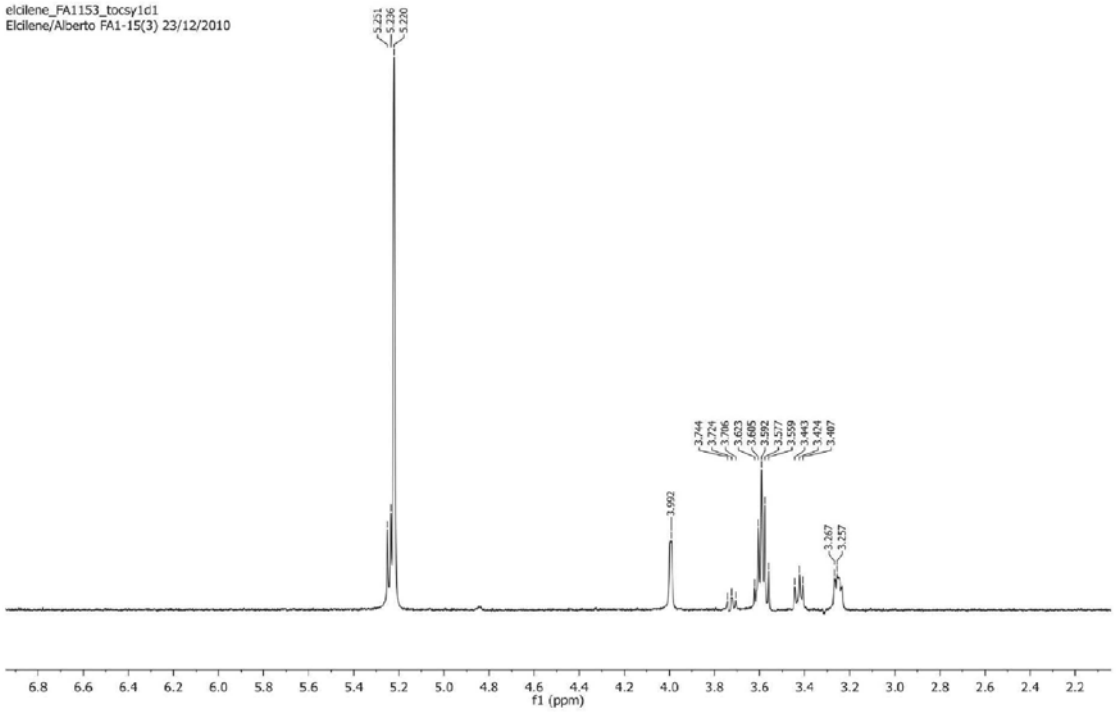

Figure S6. TOCSY 1D NMR experiment (CD_3OD, 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

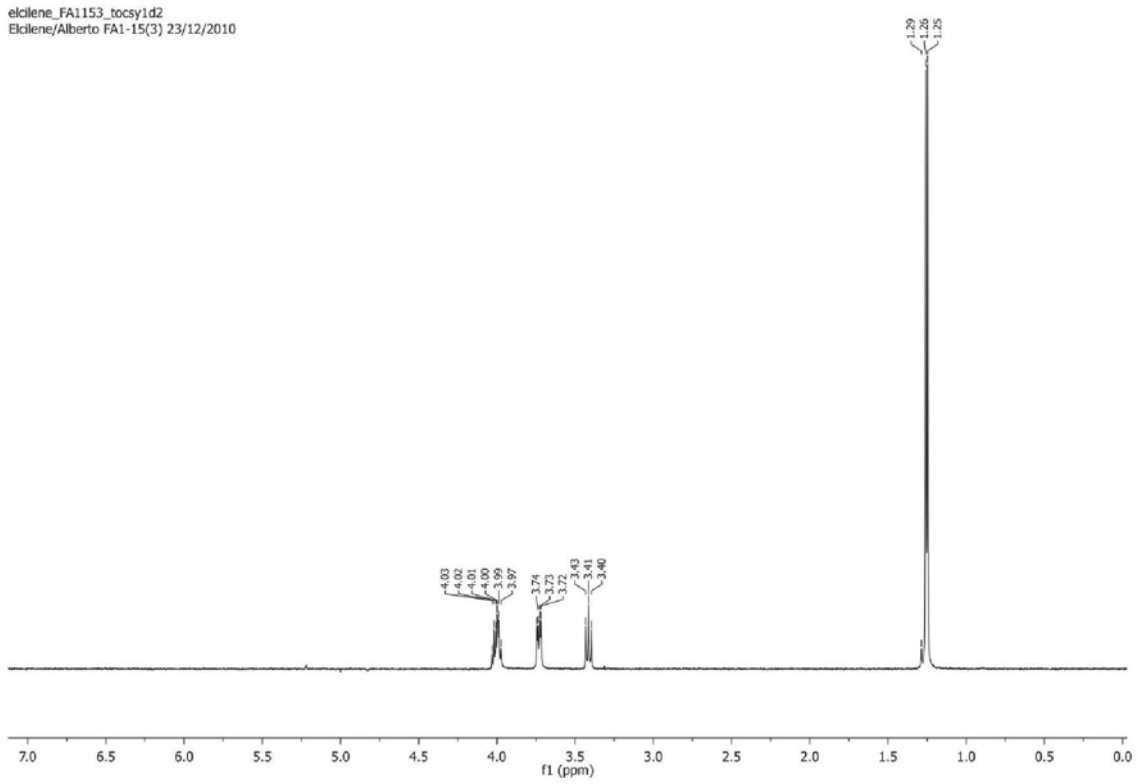

Figure S7. TOCSY 1D NMR experiment (CD_3OD, 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*. Irradiation of the signal δ 5.22.

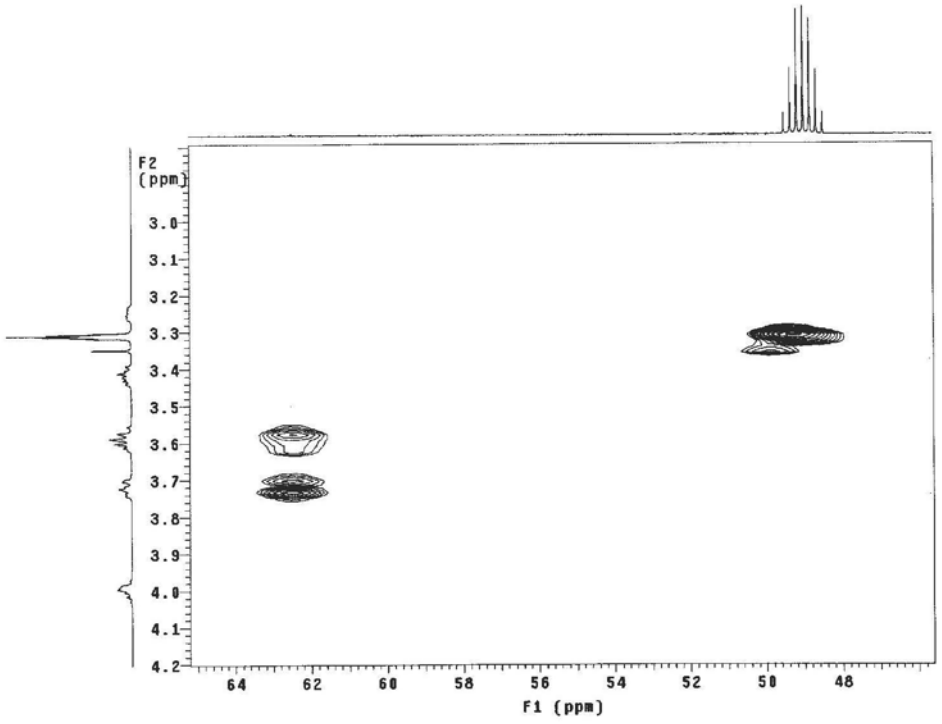

Figure S8. Expansion HMQC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

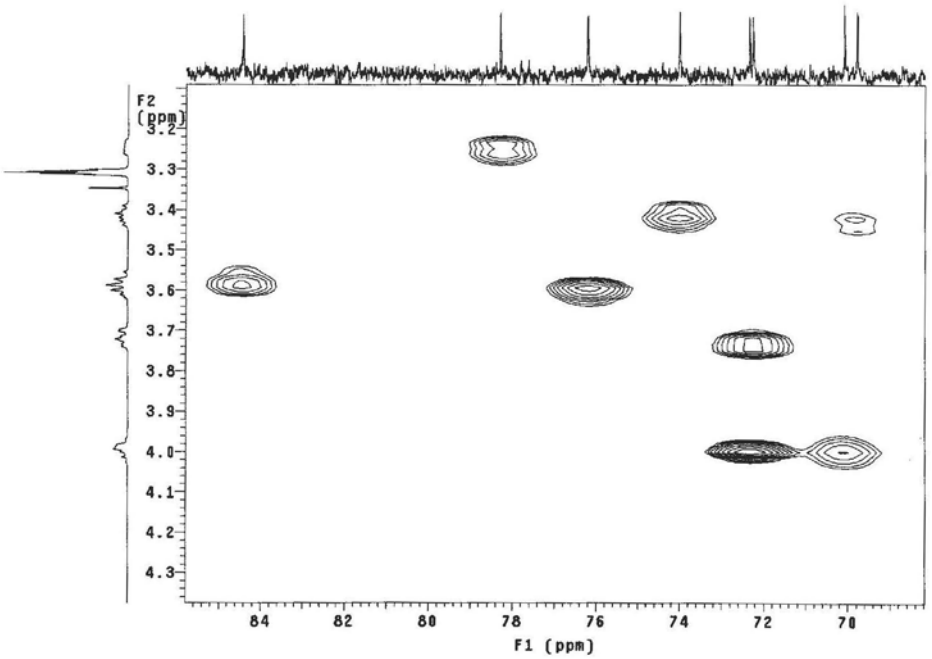

Figure S9. Expansion HMQC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

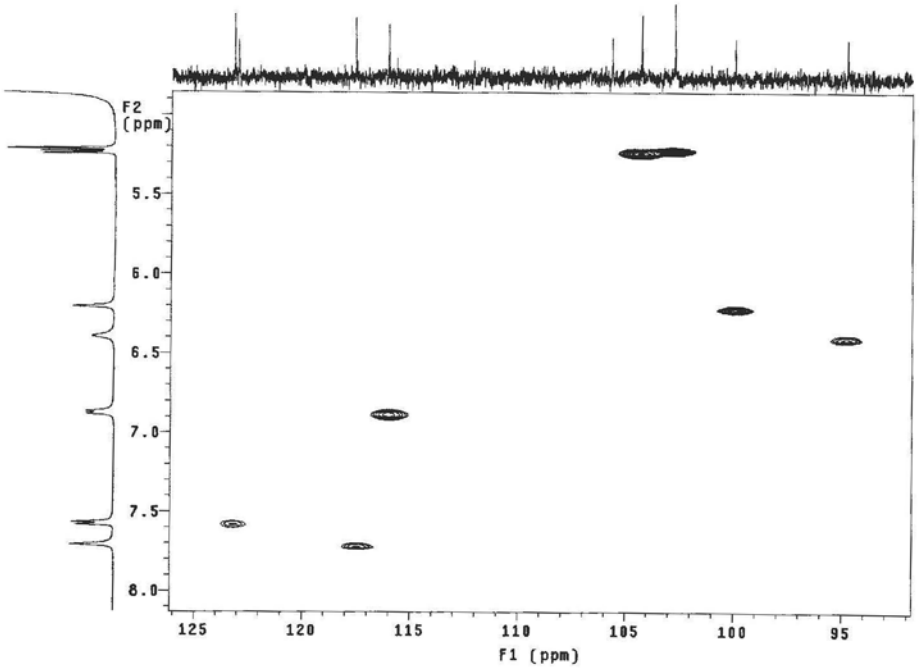

Figure S10. Expansion HMQC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

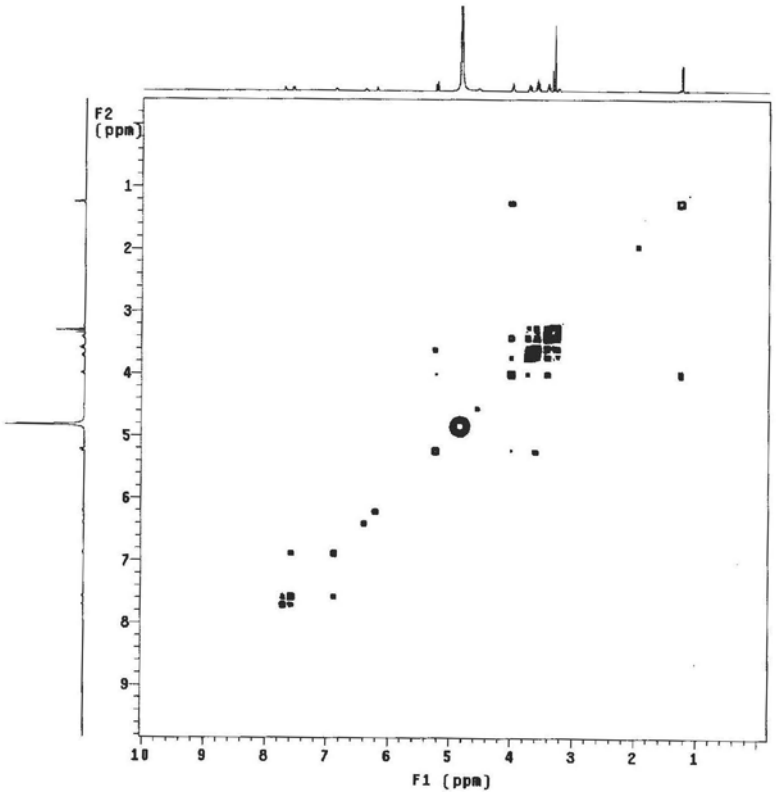

Figure S11. gCOSY NMR experiment (CD_3OD, 500 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

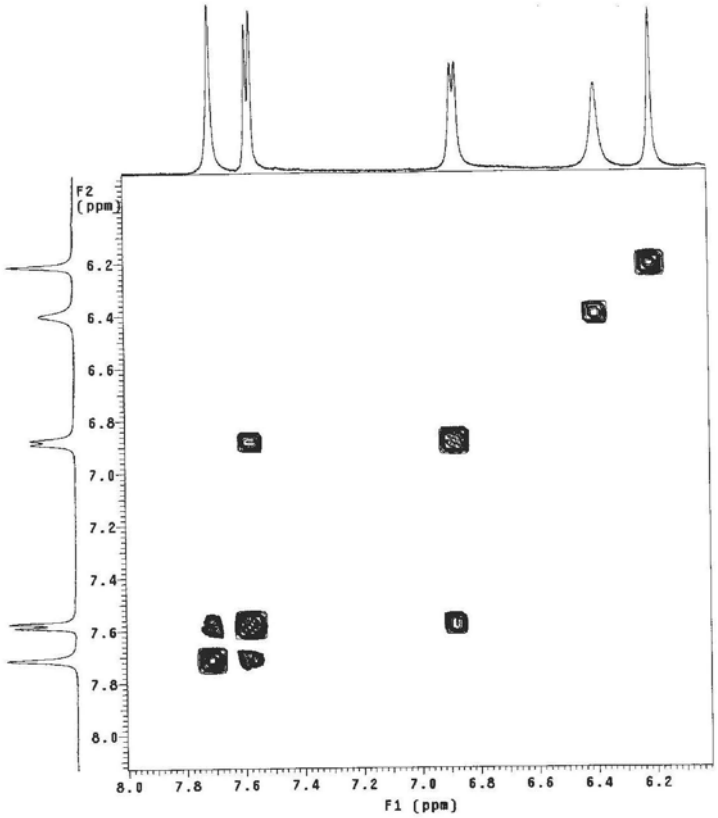

Figure S12. Expansion gCOSY NMR experiment (CD_3OD, 500 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

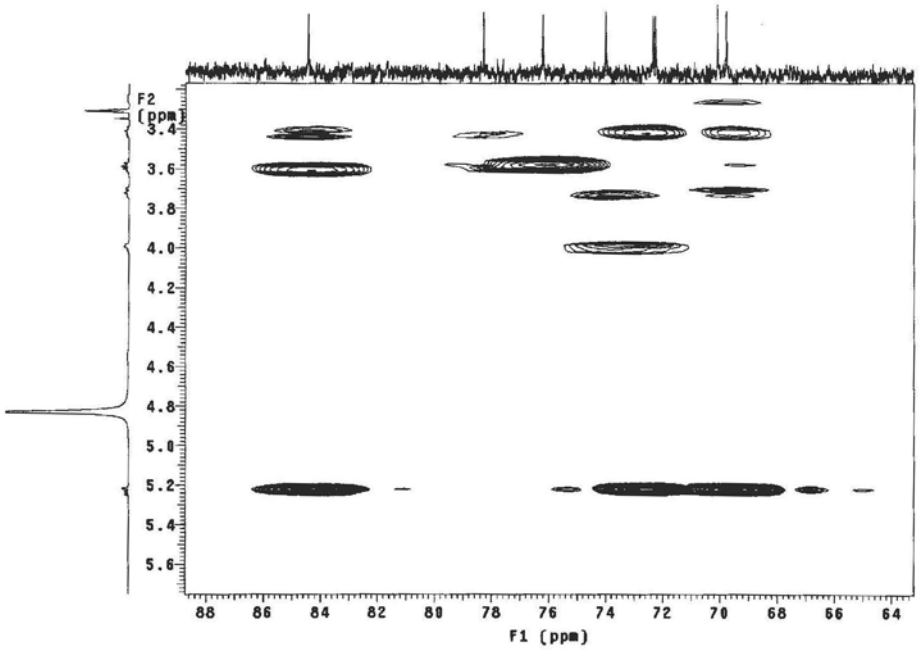

Figura S13. Expansion HMBC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

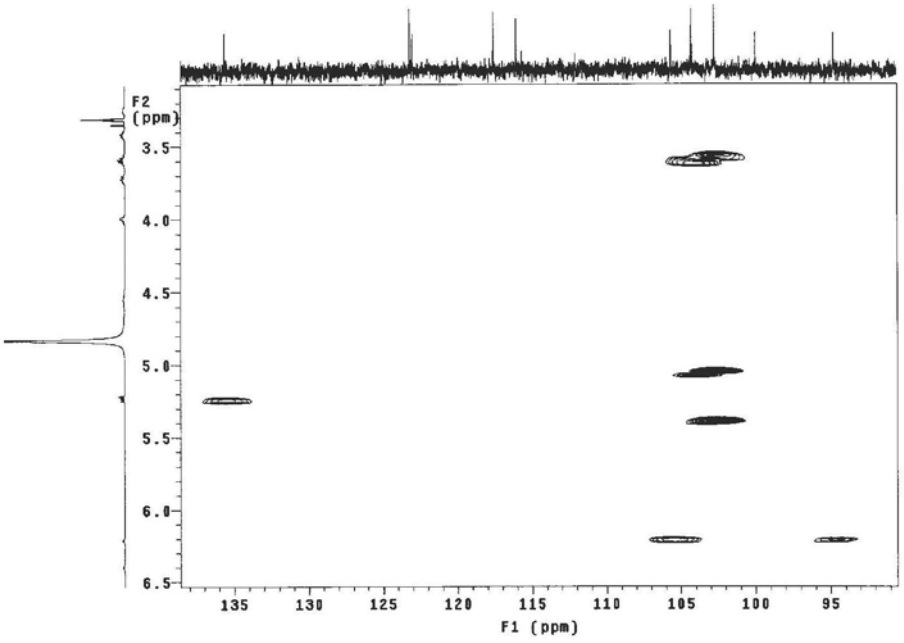

Figure S14. Expansion HMBC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

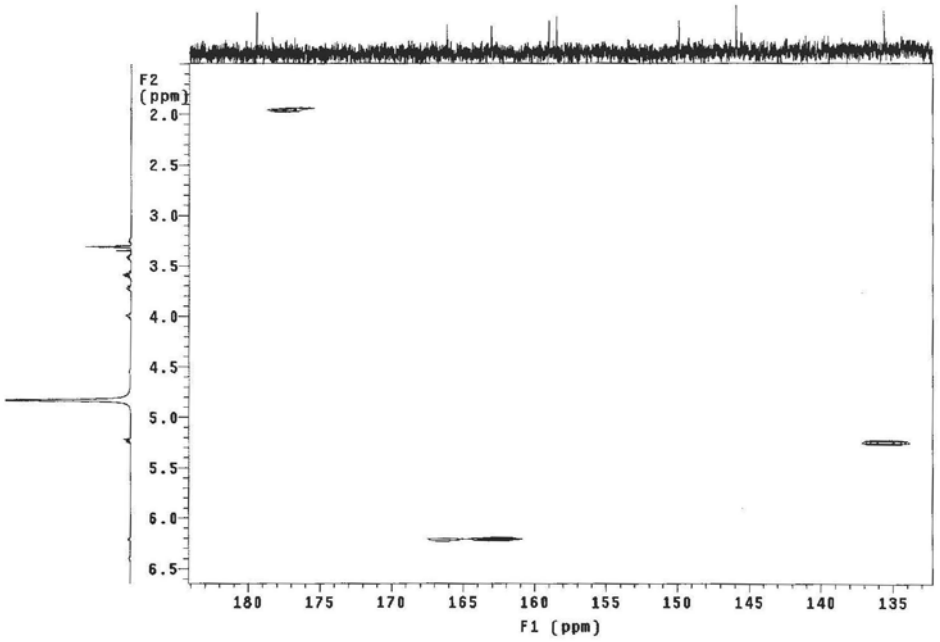

Figure S15. Expansion HMBC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

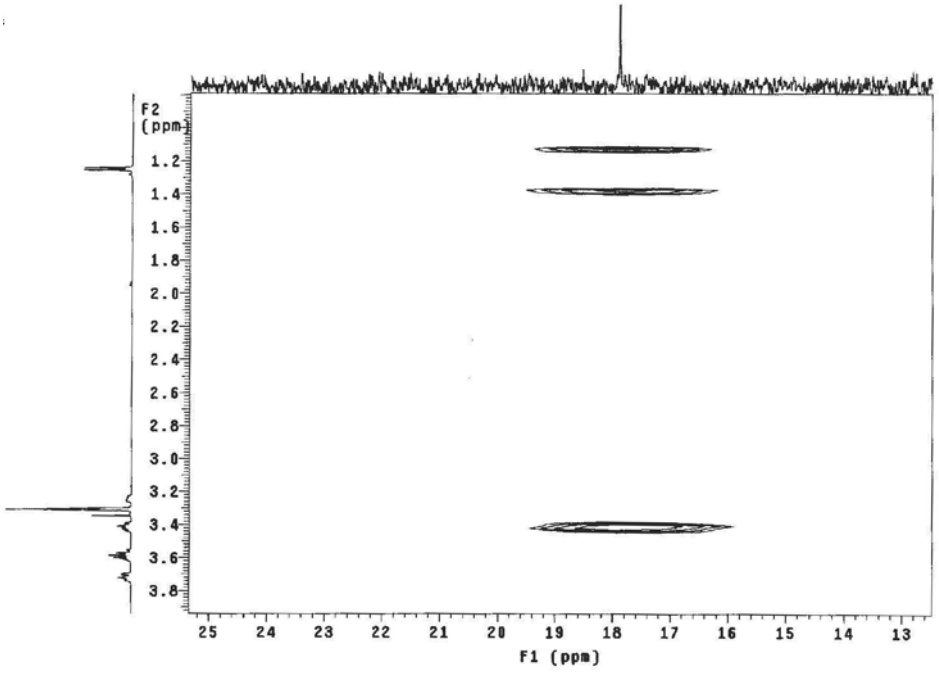

Figure S16. Expansion HMBC NMR experiment (CD_3OD, 500 × 125 MHz) of compound **1** isolated from leaves of *Oxandra sessiliflora*.

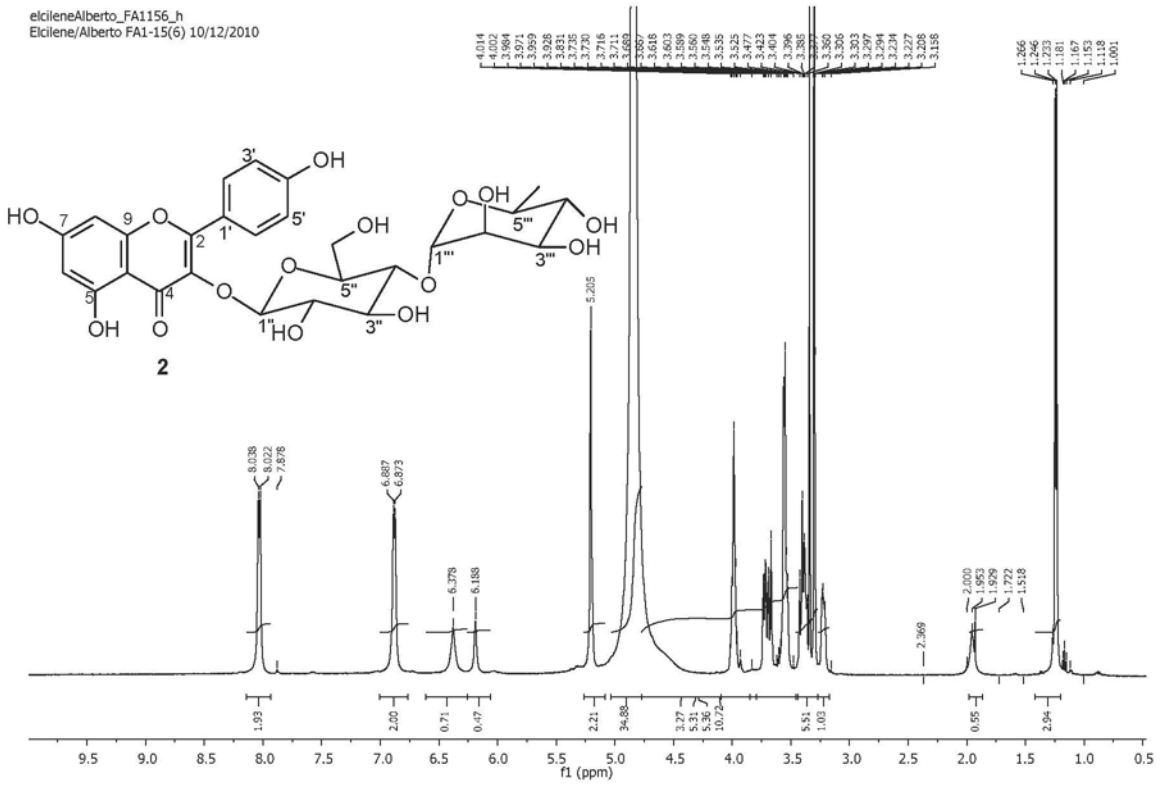

Figure S17. ^{1}H NMR spectrum (CD_3OD, 500 MHz) of compound **2** isolated from leaves of *Oxandra sessiliflora*.

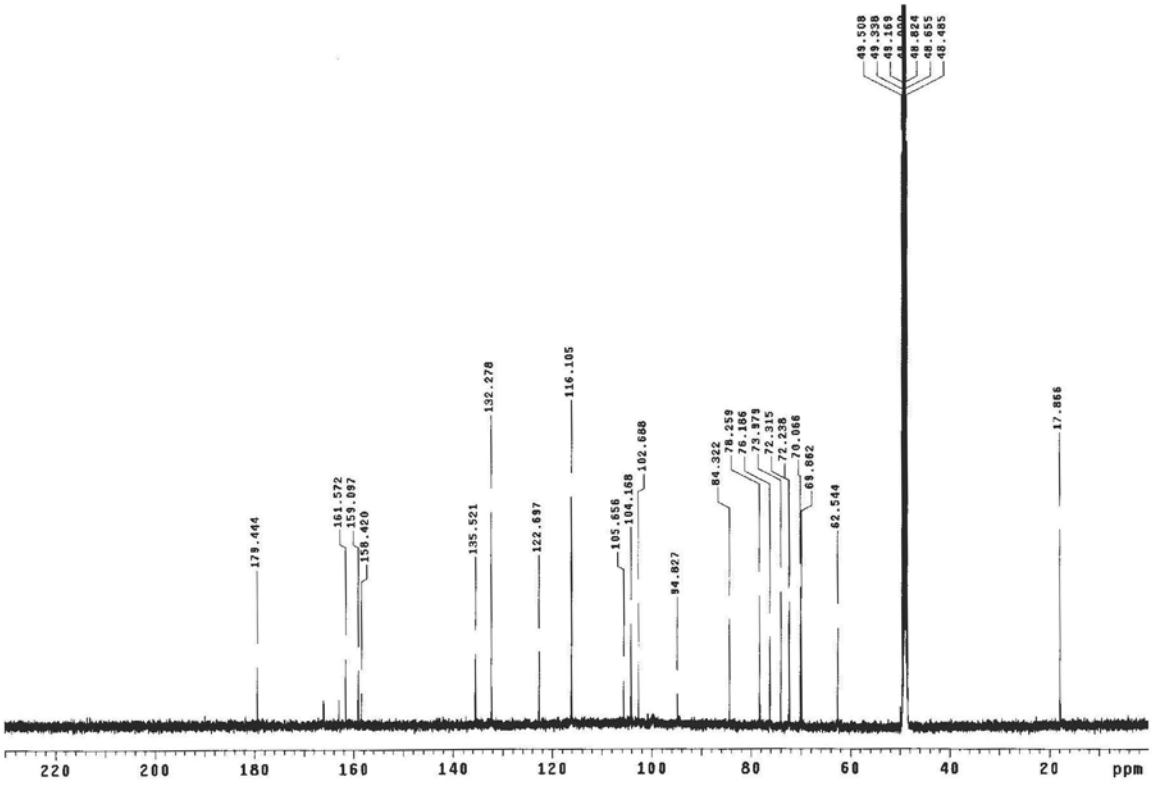

Figure S18. ^{13}C NMR spectrum (CD_3OD, 125 MHz) of compound **2** isolated from leaves of *Oxandra sessiliflora*.

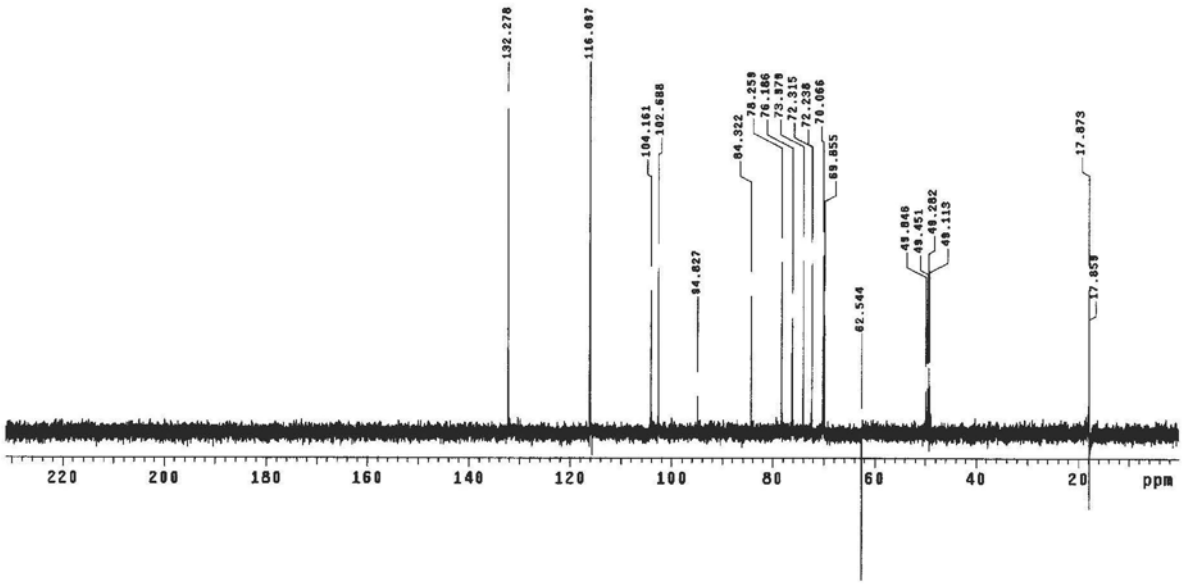

Figure S19. DEPT 135° NMR experiment (CD_3OD, 125 MHz) of compound **2** isolated from leaves of *Oxandra sessiliflora*.

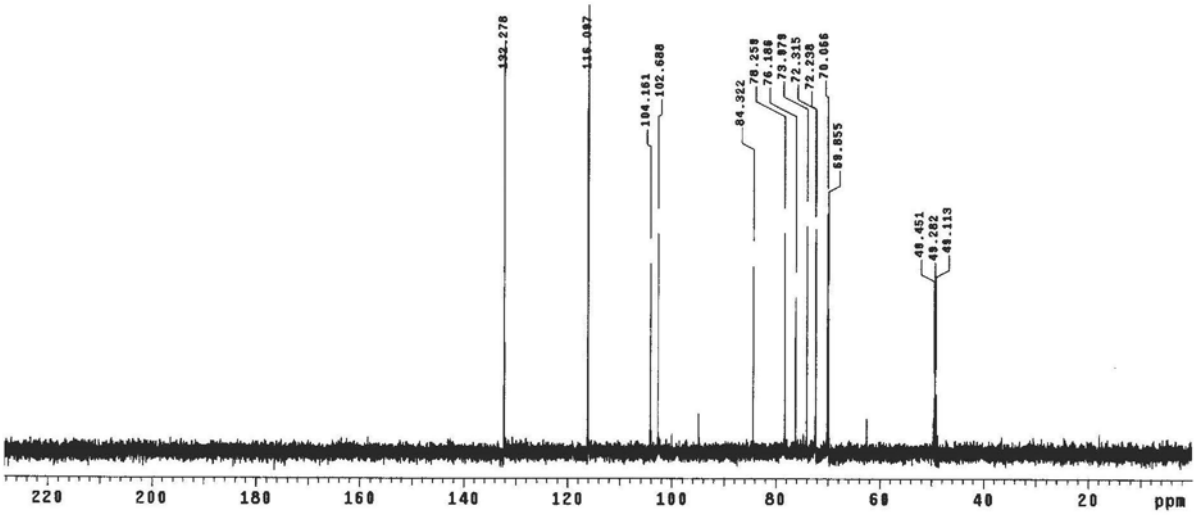

Figure S20. DEPT 90° NMR experiment (CD_3OD, 125 MHz) of compound **2** isolated from leaves of *Oxandra sessiliflora*.

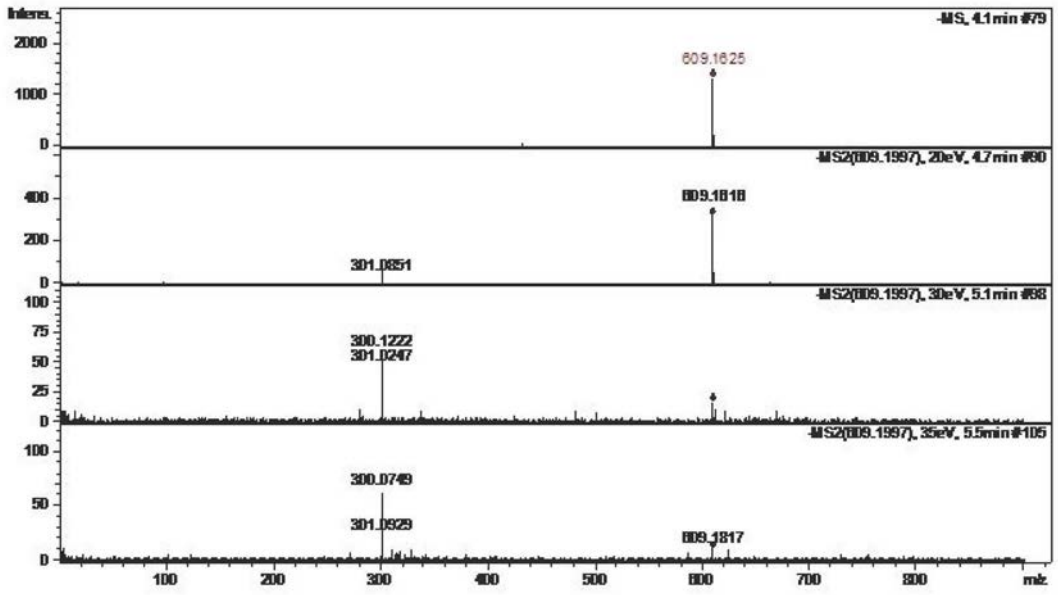

Figure S21. HRESIMS and MS/MS spectrum (negative mode) of compound **3** isolated from leaves of *Oxandra sessiliflora*.

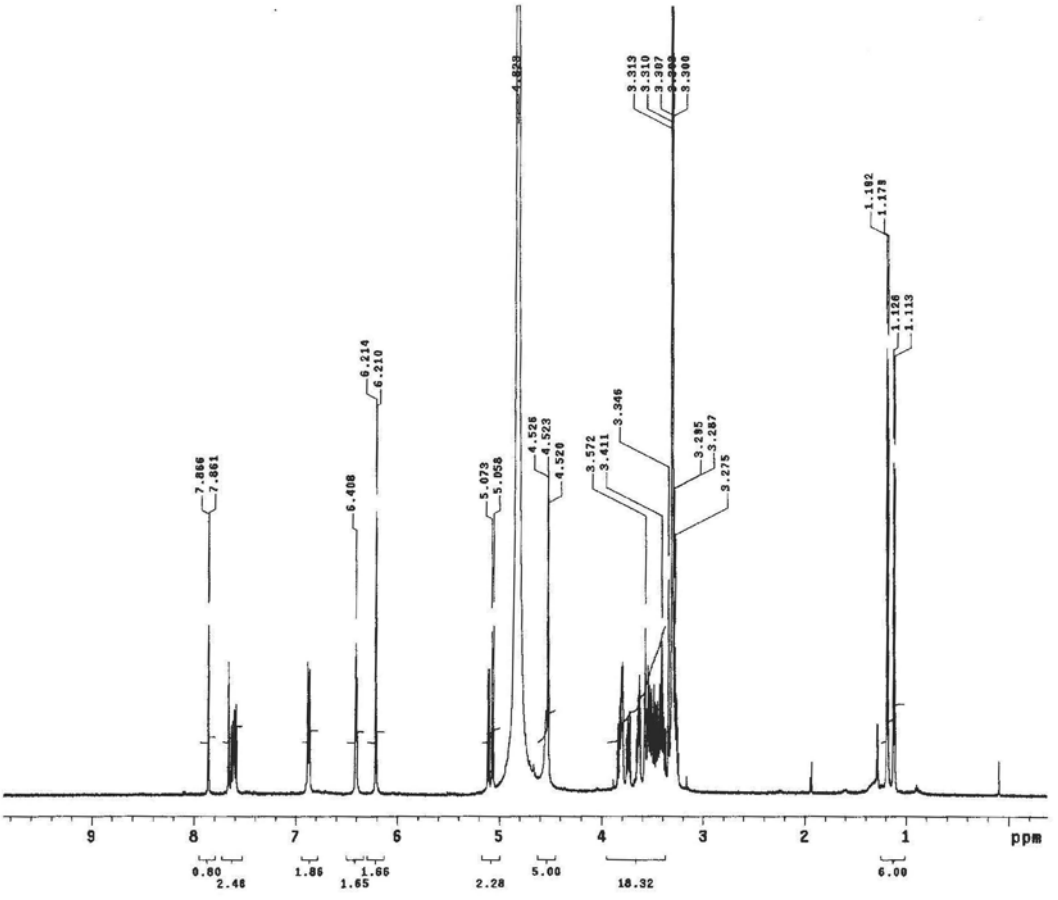

Figure S22. ^{1}H NMR spectrum (CD_3OD, 500 MHz) of compound **3** isolated from leaves of *Oxandra sessiliflora*.

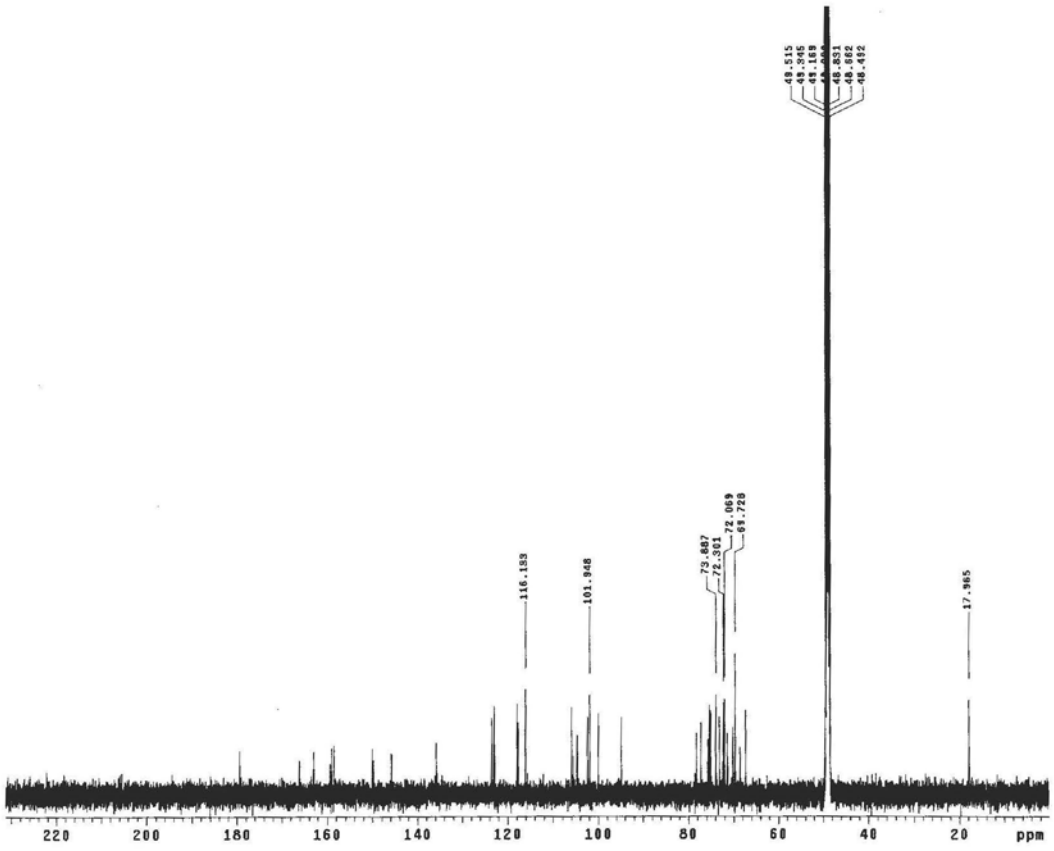

Figure S23. ^{13}C NMR spectrum (CD_3OD, 125 MHz) of compound **3** isolated from leaves of *Oxandra sessiliflora*.

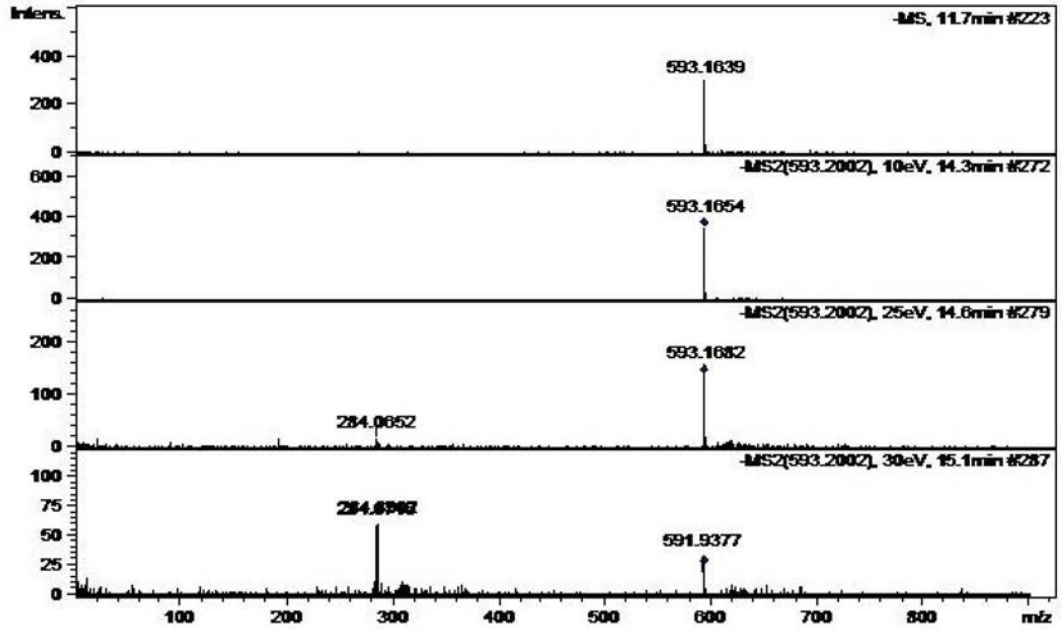

Figure S24. HRESIMS and MS/MS spectrum (negative mode) of compound **4** isolated from leaves of *Oxandra sessiliflora*.

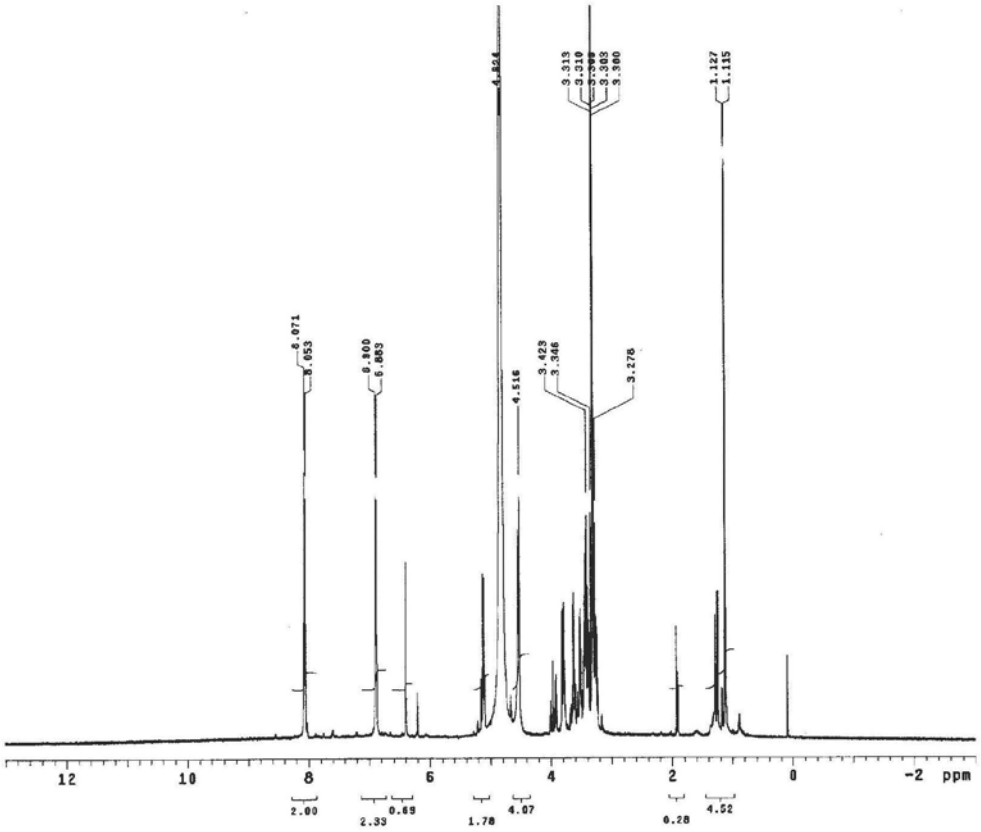

Figure S25. ^{1}H NMR spectrum (CD_3OD, 500 MHz) of compound **4** isolated from leaves of *Oxandra sessiliflora*.

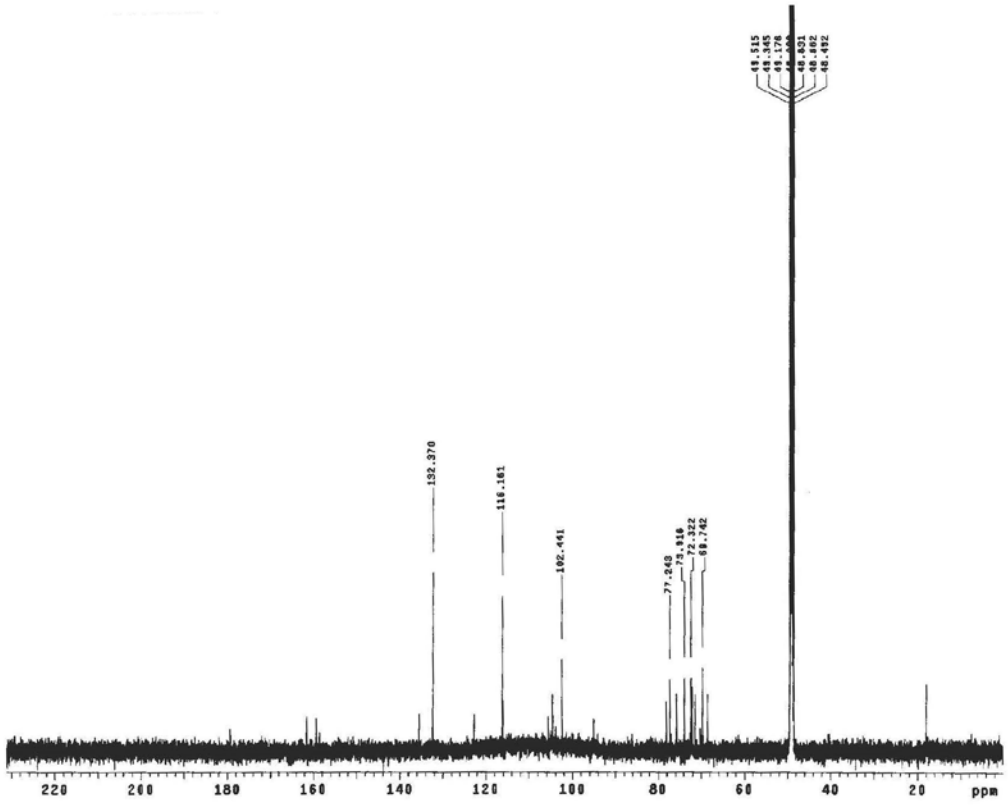

Figure S26. ^{13}C NMR spectrum (CD_3OD, 125 MHz) of compound **4** isolated from leaves of *Oxandra sessiliflora*.