Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(3):295-298

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Oregonin from the barks and xylems of Chinese *Alnus* species

Ha-Na Choi[1#], Seo-Woo Joung[1#], Hye-Young Jin[2] and Sun-Eun Choi[1*]

[1]*Department of Cosmetology Science, Nambu University, GwangJu Metropolitan City, Republic of Korea*
[2]*Division of Horticulture and Education, Korea National Arboretum, 487-821, Pocheon-si, Republic of Korea*
 # These authors contributed equally to this work

ABSTRACT

*A diarylheptanoid, (5S)-1,7-bis-(3,4-dihydroxyphenyl)-5-hydroxyheptane-3-on-5-O-β-D-xyiopyranoside, named as oregonin (**1**), was isolated from the barks and xylems of Alnus ferdinandi-coburgii C.K. Schneid. which is a species of the genus Alnus species, growing throughout China. The structure elucidation was accomplished by various spectroscopic methods including Negative FAB-MS, ^{1}H-NMR and ^{13}C-NMR techniques or comparison with authentic samples.*

Keywords: *Alnus ferdinandi-coburgii*, Betulaceae, diarylheptanoid, Chemotaxonomy

---

INTRODUCTION

Genus *Alnus* refers to deciduous broad-leaved trees or shrubs found in damp areas and mountains and comprises of more than 10 species, *A. ferdinandi-coburgii*, *A. cremastogyne*, *A. lanata*, *A. nepalensis*, *A. henryi*, *A. mandshurica*, *A. hirsuta*, *A. formosana*, *A. japonica*, *A. trabeculosa* are growing in China[1]. The barks and xylems of Chinese *Alnus* species as well as 95% EtOH extracts of *A. nepalensis* (bar code; FBM021-002), *A. japonica* (bar code; FBM068-027) *and A. ferdinandi-coburgii*(bar code; FBM071-014) were purchased from the International Biological Material Research Center.

previous work
Diarylheptanoids are characteristic components of the *Alnus* species[2,3]. Several interesting biological activities of diarylheptanoids including their anti-inflammatory[4-7] and anti-oxidant properties[8] and anti-atopic dermatitis[19] have previously been reported. In a previous study conducted in our lab, quantitative analysis of diarylheptanoids including oregonin (**1**) was conducted using HPLC on *Alnus japonica, Alnus hirsuta and Alnus hirsuta* var. *sibirica*[9], *Alnus pendula*, *Alnus firma*, *Alnus maximowiczii*[10], *Alnus tinctoria* Sarg., *Alnus japonica* (stem, leaf), *Alnus hirsuta* (stem, leaf) and *Alnus hirsuta Turcz* var. *sibirica* Fischer (stem, leaf)[11].

Here, as part of our continuous search for diarylheptanoids from new natural sources, we describe the isolation and identification of oregonin (**1**) from the barks and xylems of *A. ferdinandi-coburgii* and screening of oregonin (**1**) from some other *Alnus* species *A. nepalensis* and *A. japonica*.

EXPERIMENTAL SECTION

General experimental procedure

Thin layer chromatography (TLC) was carried out using a pre-coated silica gel 60 F_{254} plate (Merck, Darmstadt, Germany) on chloroform, methanol and water (70:30:4, volume ratio). The spots were detected under UV radiation (254 nm) and by spraying with $FeCl_3$ and 10% H_2SO_4 followed by heating.

The components from the *Alnus* species were identified by several instrumental analyses. The 1 D NMR such as ^{1}H- (300 or 600MHz) and ^{13}C- (75 or 150MHz) nuclear magnetic resonance (NMR) experiments were recorded with Gemini 2000 and VNS (Varian, Palo Alto, CA, USA) at center for research facilities on Chung-Ang University. Low resolution fast atom bombardment mass spectrum (LRFAB-MS) were recorded with JMSAX505WA (JEOL, Tokyo, Japan) at National Center for Inter-University Research Facilities on Seoul National University.

Quantitative analysis of Oregonin (1) of Chinese *Alnus* species using high pressure liquid chromatography (HPLC) :

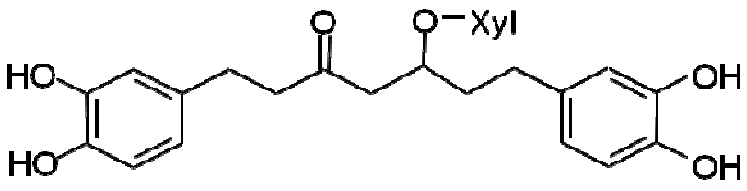
HPLC was used for the quantitative analysis of the oregonin contents. An Waters 600 series HPLC system (Milford, MA, USA), was employed and equipped with a vacuum degasser, a binary pump, a UV detector and column compartment. Oregonin (**1**) was separated on Kromasil 100-5 C18 (4.6 × 250 mm, 5μm particle) with an linear gradient water: acetonitrile = 90:10 to 60:40 for 30 min. The column temperature was maintained at room temperature and the flow rate was 1.0 ml/min. The system was monitored at 280 nm (λ_{max} of 1) eluting at 18.64 min. Oregonin was detected in all extracts. We were able to quantify oregonin (**1**) from the barks and xylems extract of *A. ferdinandi-coburgii* (0.70 ± 0.001%), *A. nepalensis* (0.71 ± 0.002%) and *A. japonica* (0.70 ± 0.002%) using a calibration equation (y=5201.9x-47967; R^2=0.9985).

Oregonin (**1**) : Brown amorphous powder, Negative FAB MS: *m/z* 477 $[M-H]^-$, ^{1}H-NMR (600MHz, DMSO-d_6+D_2O): δ 6.74-6.71 (4H in total, H-2′,2″,5′,5″), 6.53-6.50 (2H in total, H-6″, 6′), 4.31 (1H, br d, *J*=7.8Hz, xyl-1), 4.14 (1H, m, H-5), 3.86 (1H, dd, *J*=11.4, 6Hz xyl-5e), 3.54(1H, m, xyl-4), 2.83-2.52 (8H in total, H-1,2,4,7), 1.80-1.76 (2H in total, m, H-6) [12-14]. ^{13}C-NMR (150 MHz, DMSO-d_6 + D_2O): see Table 1[12-14].

Table 1. ^{13}C-NMR spectra of Compound 1

Carbon No.	Compound 1
C-1	29.7
C-2	46.1
C-3	210.6
C-4	48.2
C-5	76.1
C-6	38.3
C-7	31.4
C-1′	133.9
C-1″	134.9
C-2′	116.1
C-2″	116.2
C-3′	145.9
C-3″	145.9
C-4′	144.0
C-4″	144.3
C-5′	116.4
C-5″	116.5
C-6′	120.5
C-6″	120.4
Xyl-1	104.0
Xyl-2	74.6
Xyl-3	77.5
Xyl-4	70.8
Xyl-5	66.6

* 150 MHz (DMSO-d_6 + D_2O)



1

Fig. 1. Chemical structures of compound 1 isolated from *Alnus ferdinandi-coburgii*

Fig. 2. Comparative result of TLC chromatogram (10% sulfuric acid test)

TLC conditions: stationary phase (Silica gel 60 F_{254}), developing solvent[($CHCl_3$/MeOH/H_2O(70:30:4)] and detection (diluted sulfuric acid test solution for spraying 105 ℃, 5min), ①A. japonica, ②A. nepalensis, ③ A. ferdinandi-coburgii

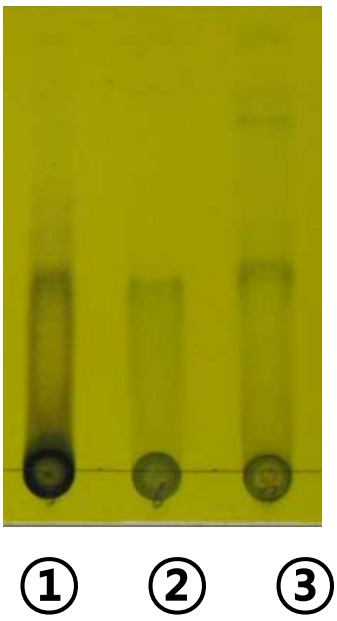


Fig. 3. Comparative result of TLC chromatogram ($FeCl_3$ test)

TLC conditions: stationary phase (Silica gel 60 F_{254}), developing solvent[$CHCl_3$/MeOH/H_2O(70:30:4)] and detection ($FeCl_3$ test solution for spraying, dry), ①A. japonica, ②A. nepalensis, ③ A. ferdinandi-coburgii

Table 2. Retention time of Oregonin (1) from Chinese *Alnus* species

Material	Retention time (min)
	Oregonin (1)
Standard	18.64 ± 0.01
A. japonica (barks and xylems)	18.74 ± 0.15
A. nepalensis (barks and xylems)	18.63 ± 0.02
A. ferdinandi-coburgii (barks and xylems)	18.65 ± 0.03

The results are expressed as means ±S.D (n=3).

Table 3. Contents of Oregonin (1) from Chinese *Alnus* species

Material	Contents (%)
	Oregonin (1)
A. japonica (barks and xylems)	0.70 ± 0.002
A. nepalensis (barks and xylems)	0.71 ± 0.002
A. ferdinandi-coburgii (barks and xylems)	0.70 ± 0.001

The results are expressed as means ±S.D (n=3).

RESULTS AND DISCUSSION

Chemotaxonomic significance

This is a report on the isolation and identification of oregonin (**1**) from *Alnus ferdinandi-coburgii* Since the initial isolation of oregonin (**1**) from *Alnus rubra*[14], and oregonin (**1**) has only been distributed among *Alnus hirsuta*[3], *Alnus cordata*, *Alnus incana*, *Alnus virdis* and *Alnus glutinosa*[15] *Alnus japonica*[16], *Alnus serrulatoides*[12,13], *Pinus flexilis*[17], *Alnus pendula*[10,18] and *Alnus tinctoria*[11].

Acknowledgements

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (Ministry of Education) [NRF-2010-355-E00067] and this study was supported (in part) by research funds from Nambu University, 2016.

REFERENCES

[1]. Flora of China, *Missouri Botanical Garden Press, St. Louis, and Science Press, Beijing,* **4**, 301–304. (**1999**).
[2] Y Asakawa. *B. Chem. Soc. Jpn*., **1971**, 44, 2761.
[3] MW Lee; T Tanaka; GI Nonaka; I Nishioka. *Phytochemistry*, **1992**, 31, 2835.
[4] MW Lee; NY Kim; MS Park; KH Ahn; SH Toh; DR Hahn; YC Kim; HT Chung. *Planta. Med.*, **2000**, 66, 551.
[5] MW Lee; JH Kim; DW Jeong; KH Ahn; SH Toh; YJ Surh. *Biol. Pharm. Bull*., **2000**, 23, 517.
[6] JM Han; WS Lee; JR Kim; JS Son; KH Nam; SC Choi; JS Lim; TS Jeong. *J. Agr. Food. Chem.*, **2007**, 55, 9457.
[7] JM Han; WS Lee; JR Kim; JS Son; OH Kwon; HJ Lee; JJ Lee; TS Jeong. *J. Agr. Food. Chem.*, **2008**, 56, 92.
[8] YA Lee; DW Jeong; KH Kim; JS Kim; SW Kim; MW Lee. *Yakhak Hoeji*, **2000**, 47, 193.
[9] HW Lim; MK Kim; HJ Kim; JG Shim; GH Kim; HK Choi; MW Lee. *Kor. J. Pharmacog.*, **2004**, 35, 384.
[10] SE Choi. *Asian Journal of Chemistry*, **2013**, 25, 6989.
[11] EK Ko; HN Choi; HY Jin; SE Choi. *JOCPR.*, **2015**, 7, 234.
[12] S Ohta; T Aoki; T Hirata; T Suga. *J. Chem. Soc.*, **1984**, 1, 1635.
[13] T Suga; S Ohta; T Hirata; T Aoki; *Chem. Lett*., **1982**, 6, 895.
[14] JJ Karchesy; ML Laver; DF Barofsky; E Barofsky. *Chem. Commun*., **1974**, 649.
[15] NR Guz; P Lorenz; JP Metraux. *Biochem. Syst.*, **2002**, 30, 471.
[16] T Aoki; S Otha; T Suga. *Phytochemistry*, **1990**, 29, 3611.
[17] KK Lee; BD Bahler; GA Hofman; MR Mattern; RK Johnson; DGI. Kingston. *J. Nat. Prod.*, **1998**, 61, 1407.
[18] SE Choi; KH Park; MH Kim; JH Song; HY Jin; MW Lee. *Natural Product Sciences*., **2012**, 18, 106.
[19] SE Choi; MS Jeong; MJ Kang; DI Lee; SS Joo; CS Lee; H Bang; MK Lee; SC Myung; YW Choi; K Lee; SJ Seo; MW Lee. *Exp*. *Dermatol*, **2010**, 19, e37.