Turk J Chem
30 (2006) , 391 – 400.

Iridoid, Flavonoid, and Phenylethanoid Glycosides from *Wiedemannia orientalis*

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Received 09.11.2005

Five iridoid glycosides, lamiide, ipolamiide, ipolamiidoside, 6β-hydroxyipolamiide, and 5-hydroxy-8-*epi*-loganin; 5 flavonoid glycosides, apigenin 7-*O*-β-glucopyranoside, luteolin 5-*O*-β- glucopyranoside, isorhamnetin 3-*O*-rutinoside, quercetin 3-*O*-rutinoside, and apigenin 7-*O*-(6$''$-O-*trans*-*p*-coumaroyl) β-glucopyranoside; and a phenylethanoid glycoside, acteoside (= verbascoside), were isolated from the aerial parts of *Wiedemannia orientalis* (Lamiaceae). Their structures were identified using spectral methods (UV, 1D- and 2D-NMR, and EI-MS).

Key Words: Lamiaceae, *Wiedemannia orientalis,* iridoid glycoside, flavonoid glycoside, phenylethanoid glycoside.

Introduction

The genus *Wiedemannia* (Lamiaceae) is represented by 2 species in the flora of Turkey. *Wiedemannia orientalis* Fisch. & Mey. (Lamiaceae) is an endemic species and is widespread throughout Anatolia[1]. Only one report has been published on the chemical constituents of *Wiedemannia orientalis.* In that report, water-distilled essential oil from fresh aerial parts of *Wiedemannia orientalis* was analyzed by GC and GC-MS, and 31 compounds were identified with germacrene D (38.94%), geijerene (14.60%), and pregeijerene (12.90%) as the major constituents[2]. In the present study, we report on the isolation and structure elucidation of 5 iridoid glycosides, lamiide (1), ipolamiide (2), ipolamiidoside (3), 6β-hydroxyipolamiide (4), and 5-hydroxy-8-*epi*-loganin (5); 5 flavonoid glycosides, apigenin 7-*O*-β- glucopyranoside (6), luteolin 5-*O*-β- glucopyranoside (7), isorhamnetin 3-*O*-rutinoside (8), quercetin 3-*O*-rutinoside (9), and apigenin 7-*O*-(6$''$-*O*-*trans*-*p*-coumaroyl) β-glucopyranoside (10); and a phenylethanoid glycoside, acteoside (11), from the aerial parts of *Wiedemannia orientalis* Fisch. & Mey.

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Experimental

General Experimental Procedures: ^{1}H- and ^{13}C-NMR spectra were recorded on a Varian Mercury Plus 400 MHz for proton and a 100 MHz for carbon by using TMS as the internal standard. Solvents were CD_3OD and DMSO-d_6. EI-MS was performed on a Finnigan MAT 95 spectrometer. Silica gel 60 (0.063-0.200 mm, Merck) and Sephadex LH-20 (Fluka) were used for open column chromatographic separations. Lichroprep RP-18 (25-40 μm, Merck) material was used for vacuum liquid chromatography (VLC). TLC was carried out on pre- coated Kieselgel 60 F_{254} aluminum sheets (Merck) and compounds were detected under UV (254 nm) fluorescence and sprayed with 1% vanillin-H_2SO_4 reagent, followed by heating at 105 °C for 1-2 min.

Plant Material: *Wiedemannia orientalis* (Lamiaceae) was collected from Sivrihisar, Eskişehir, Turkey, in May 2004. A voucher specimen was deposited in the herbarium of the Pharmacognosy Department, Faculty of Pharmacy, Hacettepe University, Ankara, Turkey (HUEF 04163).

Extraction and Pre-purification: Open-air-dried and powdered aerial parts of the plant (131 g) were extracted 3 times with MeOH at 40 °C (3 x 2 L). After evaporation of the combined extract in vacuo, 26 g of MeOH extract was obtained. The crude extract was dissolved in water and partitioned with $CHCl_3$ (3 x 0.2 L) to give the $CHCl_3$ extract (5.0 g). The aqueous phase was further extracted with n-butanol (5 x 0.25 L) and the organic layer was evaporated to dryness (12.6 g). The n-BuOH extract of the plant was chosen for further phytochemical studies as given below.

Isolation of the Compounds: n-Butanol extract was re-dissolved in MeOH and chromatographed on a silica gel column eluting with $CHCl_3$-MeOH-H_2O mixtures (80:20:2 and 61:32:7), respectively to yield 5 main fractions (Fr. A: 570 mg; Fr. B: 1.6 g; Fr. C: 1.4 g; Fr. D: 588 mg; Fr. E: 980 mg). Fr. A was subjected to a column of Sephadex LH 20 eluting with MeOH to yield Fr. A_1 (433 mg) and Fr. A_2 (83 mg). Fr. A_1 was subjected to VLC on reversed-phase material using MeOH-H_2O mixtures (0%-100%) to give Fr. $A_{1.1}$ (16 mg) and Fr. $A_{1.2}$ (47.8 mg). Further processing of Fr. $A_{1.1}$ on a silica gel column by eluting with $CHCl_3$-MeOH-H_2O (61:32:7) gave compound **4** (11.5 mg). Silica gel chromatography of Fr. $A_{1.2}$ by eluting with $CHCl_3$-MeOH-H_2O (70:30:3) gave compound **3** (20 mg). Fr. A_2 was subjected to a column of Sephadex LH 20 by eluting with MeOH to yield Fr. $A_{2.1}$ (61 mg) and Fr. $A_{2.2}$ (15 mg). Fr. $A_{2.2}$ was subjected to VLC using reversed-phase material using a MeOH-H_2O mixture (0%-100%) to give compound **10** (7 mg). Fr. B was fractioned over RP-VLC using MeOH-H_2O mixtures (0%-100%) as eluent to give 4 fractions (Fr. B_1: 546 mg; Fr. B_2: 158 mg; Fr. B_3: 67 mg; Fr. B_4: 64 mg). Fr. B_1 was subjected to a silica gel column using $CHCl_3$-MeOH mixtures (90:10, 85:15.....70:30) to give Fr. $B_{1.1}$ (455 mg). Fr. $B_{1.1}$ was purified by preparative TLC using $CHCl_3$-MeOH-H_2O (61:32:7) mixtures to give compound **1** (70 mg). Fr. B_2 was subjected to a silica gel column using $CHCl_3$-MeOH-H_2O (61:32:7) mixtures to give Fr. $B_{2.1}$ (112 mg). Fr. $B_{2.1}$ was purified by preparative TLC using $CHCl_3$-MeOH-H_2O (61:32:7) mixtures to give Fr. $B_{2.1.1}$ (28 mg) and Fr. $B_{2.1.2}$ (38 mg). Fr. $B_{2.1.1}$ was subjected to VLC using reversed-phase material, by using MeOH-H_2O mixtures (0%-100%) to give compound **5** (18 mg). Fr. $B_{2.1.2}$ was subjected to VLC using reversed-phase material by using MeOH-H_2O mixtures (0%-100%) to give compound **2** (19 mg). Fr. B_3 was subjected to a column of Sephadex LH 20 by eluting with MeOH to give compound **7** (42 mg). Fr. B_4 was applied to a silica gel column by employing $CHCl_3$-MeOH-H_2O (70:30:3) mixtures to give Fr. $B_{4.1}$ (15 mg)and Fr. $B_{4.2}$ (25 mg). Purification of Fr. $B_{4.1}$ by Sephadex LH 20 CC using MeOH gave compound **8** (10 mg). Purification of Fr. $B_{4.2}$ by Sephadex LH 20 CC using MeOH gave compound **6** (7.5 mg). Fr. C was subjected to VLC

on reversed-phase material by using MeOH-H_2O mixtures (0%-100%) to give Fr. C_1(153 mg). Fr. C_1 was purified by preparative TLC using $CHCl_3$-MeOH-H_2O (61:32:7) mixtures to give compound **11** (52 mg). Fr. D was subjected to VLC using reversed-phase material, by using MeOH-H_2O mixtures (0%-100%) to give Fr. D_1 (67 mg). Fr. D_1 was purified by preparative TLC using $CHCl_3$-MeOH-H_2O (50:50:5) mixtures to give compound **9** (10 mg).

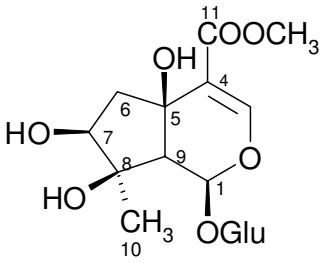
Results and Discussion

In this study, from the aerial parts of *Wiedemannia orientalis*, 5 iridoid glycosides, lamiide **(1)**, ipolamiide **(2)**, ipolamiidoside **(3)**, 6β-hydroxyipolamiide **(4)**, and 5-hydroxy-8-*epi*-loganin **(5)**; 5 flavonoid glycosides, apigenin 7-*O*-β-glucopyranoside **(6)**, luteolin 5-*O*-β- glucopyranoside **(7)**, isorhamnetin 3-*O*-rutinoside **(8)**, quercetin 3-*O*-rutinoside **(9)**, and apigenin 7-*O*-(6″-*O*-*trans*-*p*-coumaroyl) β-glucopyranoside **(10)**; and a phenylethanoid glycoside, acteoside **(11)**, were isolated by fractionation of the butanol extract through an open column chromatograph on silica gel and Sephadex LH-20, followed by VLC (Figure).

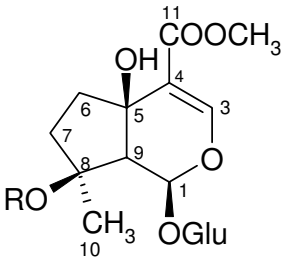
Lamiide (1): UV (MeOH) λ_{max} 232 nm**;** EIMS m/z 259 $[M\text{-}Glu]^+$, (calc. for $C_{11}H_{15}O_7$). ^{1}H NMR (CD_3OD, 400 MHz): δ 5.81 (1H, *d*, *J*= <1, H-1), 7.43 (1H, *s*, H-3), 2.24 (1H, *dd*, *J*= 15.0/2.93 Hz, H_a-6), 2.35 (1H, *dd*, *J*= 15.2/4.95 Hz, H_b-6), 3.52 (1H, *dd*, *J*= 4.95/2.95 Hz, H-7), 2.78 (1H, *brs*, H-9), 1.08 (3H, *s*, H-10), 3.72 (3H, *s*, COOMe), 4.59 (1H, *d*, *J*= 7.7 Hz, H-1′), 3.16-3.40 (4H, *m*, H-2′, H-3′, H-4′, H-5′), 3.66 (1H, *dd*, *J*= 11.7/5.9 Hz, H_a-6′), 3.89 (1H, *dd*, *J*= 11.9/1.6 Hz, H_b-6′); ^{13}C NMR (CD_3OD, 100 MHz): Table 1.

Table 1. ^{13}C NMR (CD_3OD, 100 MHz) data of compounds **1-5**.

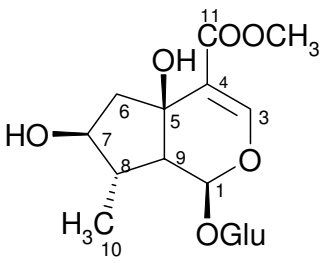
Atomic Number	**1**	**2**	**3**	**4**	**5**
Aglycone					
1	93.2	93.0	93.9	95.8	94.4
3	151.3	151.4	153.4	152.5	152.4
4	114.2	114.0	111.8	112.8	114.0
5	68.0	70.6	71.9	65.3	70.1
6	45.5	37.6	35.4	63.2	46.7
7	76.6	39.2	37.5	41.9	76.7
8	77.9	77.7	87.7	75.5	42.3
9	56.8	60.5	58.6	53.5	50.4
10	20.1	22.0	19.8	16.6	12.6
11	166.8	166.8	166.4	166.6	166.8
COOMe	50.5	50.4	50.4	50.5	50.3
COMe			172.1		
COMe			20.9		
Glucose					
1′	98.4	98.4	98.8	98.7	98.5
2′	73.2	73.2	73.2	73.5	73.2
3′	76.2	76.2	76.3	76.6	76.3
4′	70.4	70.6	70.4	70.5	70.5
5′	77.2	77.2	77.1	77.5	77.3
6′	61.5	61.7	61.5	61.8	61.7



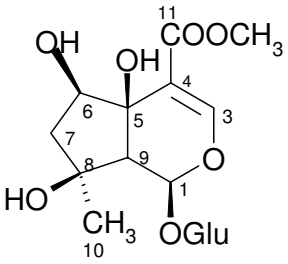
Lamiide (**1**)



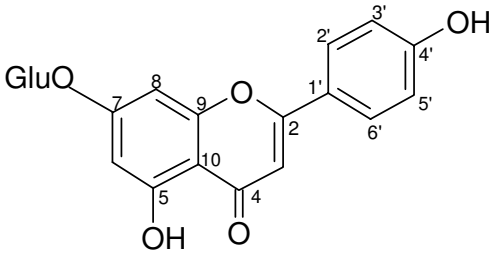
R	**Compound**
H	Ipolamiide (**2**)
Ac	Ipolamiidoside (**3**)



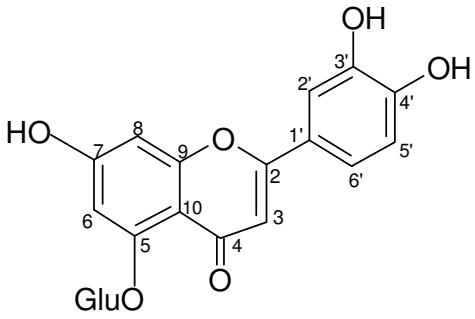
5-Hydroxy-8-*epi*-loganin (**5**)



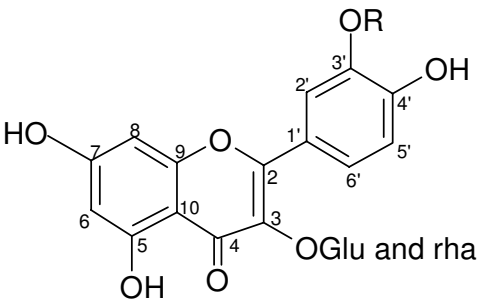
6β-Hydroxyipolamiide (**4**)



Apigenin 7-*O*-β- glucopyranoside (**6**)

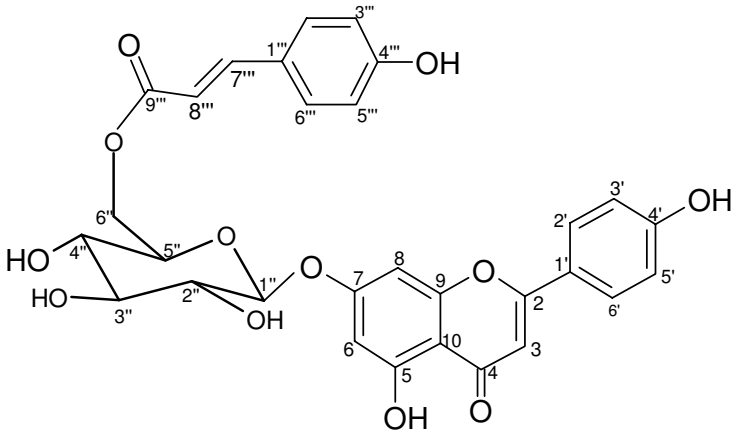


Luteolin 5-*O*-β- glucopyranoside (**7**)

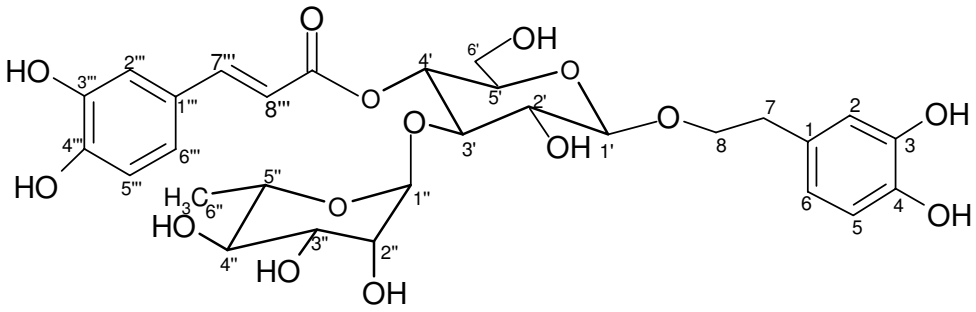


R	**Compound**
CH_3	Isorhamnetin 3-*O*-rutinoside (**8**)
H	Quercetin 3-*O*-rutinoside (**9**)

Figure. Chemical structures of the isolated compounds.



Apigenin 7-*O*-(6″-*O*-*trans*-*p*-coumaroyl) *β*-glucopyranoside (**10**)



Acteoside (**11**)

Figure. Contunied

Ipolamiide (2): UV (MeOH) $\lambda_{\max}$ 229 nm**;** EIMS m/z 244 [M-Glu]$^+$, (calc. for $C_{11}H_{15}O_6$). ^{1}H NMR (CD_3OD, 400 MHz): δ 5.80 (1H, *d*, J= 1.1 Hz, H-1), 7.43 (1H, *s*, H-3**),** 1.92 (1H, m, H_a-6), 2.26 (1H, m, H_b-6), 1.56 (1H, *m*, H_a-7), 2.08 (1H, *m*, H_b-7), 2.47 (1H, *bs*, H-9), 1.14 (3H, *s*, H-10), 3.72 (3H, *s*, COOMe)**,** 4.57 (1H, *d*, J= 8.0 Hz, H-1′), 3.17 (1H, *dd,* J= 9.1/8.0 Hz, H-2′), 3.23-3.38 (3H, *m*, H-3′, H-4′, H-5′), 3.65 (1H, *dd*, J= 11.9/6.0 Hz, H_a-6′), 3.89 (1H, *dd*, J= 11.8/2.2 Hz, H_b-6′); ^{13}C NMR **(**CD_3OD, 100 MHz): Table 1.

Ipolamiidoside (3): UV (MeOH) λ_{max}229 nm; EIMS m/z 286 [M-Glu]$^+$, (calc. for $C_{13}H_{15}O_7$). ^{1}H NMR (CD_3OD, 400 MHz): δ 6.05 (1H, *d*, J= 1.1 Hz, H-1), 7.56 (1H, *d*, J= 2.9 Hz, H-3), 2.11 (1H, *m*, H_a-6), 2.39 (1H, *m*, H_b-6), 1.62 (1H, *m*, H_a-7), 2.07 (1H, *m*, H_b-7), 2.71 (1H, *d*, J= 1.1 Hz, H-9), 1.42 (3H, s, H-10), 3.72 (3H, *s*, COOMe), 2.03 (3H, *s*, COMe), 4.57 (1H, *d*, J= 8.0 Hz, H-1′), 3.16 (1H, *dd*, J= 9.1/8.0 Hz, H-2′), 3.26-3.39 (3H, *m*, H-3′, H-4′, H-5′), 3.68 (1H, *dd*, J= 12.0/5.5 Hz, H_a-6′), 3.89 (1H, *dd*, J= 12.2/2.0 Hz, H_b-6′); ^{13}C NMR (CD_3OD, 100 MHz): Table 1.

6*β*-hydroxyipolamiide (4): UV (MeOH) λ_{max}231 nm**;** EIMS m/z 259 [M-Glu]$^+$, (calc. for $C_{11}H_{15}O_7$). ^{1}H NMR (CD_3OD, 400 MHz): δ 5.42 (1H, *d*, J= 8.4 Hz, H-1), 7.47 (1H, *s*, H-3), 3.89 (1H, *d*,

***J*=** signal pattern unclear due to overlapping, H-6), 2.27 (1H, *dd, J*= 15.4/1.8 Hz, H_a-7), 2.56 (1H, *d*, *J*= 15.7 Hz, H_b-7), 2.35 (1H, *d*, *J*= 8.7 Hz, H-9), 1.52 (3H, s, H-10), 3.70 (3H, *s*, COOMe), 4.73 (1H, *d*, *J*= 8.0 Hz, H-1′), 3.19-3.40 (4H, *m*, H-2′, H-3′, H-4′, H-5′), 3.60 (1H, *dd*, *J*= 11.9/6.6 Hz, H_a-6′), 3.91 (1H, *dd*, *J*= 12.1/2.2 Hz, H_b-6′); ^{13}C NMR (CD_3OD, 100 MHz): Table 1.

5-Hydroxy-8-*epi*-loganin (5): UV (MeOH) λ_{max}234 nm**;** EIMS *m/z* 244 [M-Glu]$^+$ (calc. for $C_{11}H_{15}O_6$). ^{1}H NMR (CD_3OD, 400 MHz): δ 5.75 (1H, *d*, *J*= 1.5 Hz, H-1), 7.47 (1H, *s*, H-3), 2.03 (1H, *dd*, *J*= 13.6/6.5 Hz, H_a-6), 2.57 (1H, *dd*, *J*= 13.6/5.5 Hz, H_b-6), 3.54 (1H, *m*, H-7), 2.26(1H, *m*, H-8), 2.79(1H, *dd*, *J*=10.3/1.1 Hz, H-9), 0.95 (3H, *d*, *J*=7.3 Hz, H-10), 3.72 (3H, *s*, COOMe), 4.55 (1H, *d*, *J*= 8.0 Hz, H-1′), 3.15-3.38 (4H, *m*, H-2′, H-3′, H-4′, H-5′), 3.64(1H, *dd*, *J*= 11.7/6.2 Hz, H_a-6′), 3.90 (1H, *dd*, *J*= 11.9/2.0 Hz, H_b-6′); ^{13}C NMR (CD_3OD, 100 MHz): Table 1.

Apigenin 7-*O*-β-glucopyranoside (6): $C_{21}H_{20}O_{10}$(mol.wt. 432); EIMS *m/z* 270 [M-Glu]$^+$; ^{1}H NMR (DMSO-d_6, 400 MHz): δ_H 6.84 (1H, *s*, H-3), 6.42 (1H, *d*, *J* = 2.2 Hz, H-6), 6.81 (1H, *d*, *J* = 2.2 Hz, H-8), 7.93 (2H, *d*, *J* = 9.1 Hz, H-2′, H-6′), 6.90 (2H, *d*, *J* = 8.8 Hz, H-3′, H-5′), 5.05 (1H, *d*, *J* = 7.3 Hz, H-1″), 3.14-3.39 (3H, *m*, H-2″, H-3″, H-4″, H-5″), 3.55 (1H, *dd*, *J* = 11.9/6.2 Hz, H_a-6″), 3.73 (1H, *dd*, *J* = 11.6/1.8 Hz, H_b-6″); ^{13}C NMR (DMSO-d_6, 100 MHz): Table 2.

Luteolin 5-*O*-β-glucopyranoside (7): $C_{21}H_{20}O_{11}$(mol.wt. 448); EIMS *m/z* 286 [M-Glu]$^+$; ^{1}H NMR (DMSO-d_6, 400 MHz): δ_H 6.54 (1H, *s*, H-3), 6.67 (1H, *d*, *J* = 2.2 Hz, H-6), 6.77(1H, *d*, *J* = 2.2 Hz, H-8), 7.33 (1H, *d*, *J* = 2.2 Hz, H-2′), 6.85 (1H, *d*, *J* = 8.4 Hz, H-5′), 7.35 (1H, *dd*, *J* = 8.4/2.2 Hz, H-6′), 4.69 (1H, *d*, *J* = 7.0 Hz, H-1″), 3.21-3.63 (4H, *m*, H-2″, H-3″, H-4″, H-5″), 3.45 (1H, *m*, H_a-6″), 3.80 (1H, *d*, *J* = 10.0/1.8 Hz, H_b-6″); ^{13}C NMR (DMSO-d_6, 100 MHz): Table 2.

Isorhamnetin 3-*O*-rutinoside (8): $C_{28}H_{32}O_{16}$(mol.wt. 624); EIMS *m/z* 316 [M-(Glu+Rh)]$^+$; ^{1}H NMR (CD_3OD, 400 MHz): δ_H 6.18 (1H, *d*, *J* = 2.2 Hz, H-6), 6.37(1H, *d*, *J* = 2.2 Hz, H-8), 7.92 (1H, *d*, *J* = 1.8 Hz, H-2′), 6.90 (1H, *d*, *J* = 8.4 Hz, H-5′), 7.62 (1H, *dd*, *J* = 8.6/2.0 Hz, H-6′), 3.94 (3H, *s*, OCH_3), 5.21 (1H, *d*, *J* = 7.3 Hz, H-1″), 3.21-3.63 (4H, *m*, H-2″, H-3″, H-4″, H-5″), 3.45 (1H, *m*, H_a-6″), 3.80 (1H, *d*, *J* = 10.0/1.8 Hz, H_b-6″), 4.52 (1H, *d*, *J* = 1.5 Hz, H-1‴), 3.21-3.53 (4H, *m*, H-2‴, H-3‴, H-4‴, H-5‴), 1.09 (3H, *d*, *J* = 6.2 Hz, CH_3-6‴); ^{13}C NMR (CD_3OD, 100 MHz): Table 2.

Quercetin 3-*O*-rutinoside (9): $C_{27}H_{30}O_{16}$(mol.wt. 610); EIMS *m/z* 301 [M-(Glu+Rh)]$^+$. ^{1}H NMR (DMSO-d_6, 400 MHz): δ_H 6.16 (1H, *d*, *J* = 2.2 Hz, H-6), 6.35 (1H, *d*, *J* = 2.2 Hz, H-8), 7.53 (1H, *d*, *J* = 1.8 Hz, H-2′), 6.81 (1H, *d*, *J* = 8.0 Hz, H-5′), 7.50 (1H, *dd*, *J* = 8.0/1.8 Hz, H-6′), 5.32 (1H, *d*, *J* = 7.4 Hz, H-1″), 3.01-3.37 (4H, *m*, H-2″, H-3″, H-4″, H-5″), 3.30 (1H, *m*, H_a-6″), 3.68 (1H, *d*, *J* = 10.3 Hz, H_b-6″), 4.36 (1H, *d*, *J* = 1.8 Hz, H-1‴), 3.01-3.37 (4H, *m*, H-2‴, H-3‴, H-4‴, H-5‴), 0.97 (3H, *d*, *J* = 6.2 Hz, CH_3-6‴); ^{13}C NMR (DMSO-d_6, 100 MHz): Table 2.

Apigenin 7-*O*-(6″-*O*-*trans*-*p*-coumaroyl) β-glucopyranoside (10): $C_{30}H_{26}O_{12}$(mol.wt**.** 578); EIMS *m/z* 578[M]$^+$, 149, 267, 311. ^{1}H NMR (DMSO-d_6, 400 MHz): δ_H 6.81 (1H, *s*, H-3), 6.45 (1H, *d*, *J* = 1.8 Hz, H-6), 6.79(1H, *d*, *J* = 1.8 Hz, H-8), 7.92 (2H, *d*, *J* = 8.7 Hz, H-2′, H-6′), 6.89 (2H, *d*, *J* = 8.7 Hz, H-3′, H-5′), 5.14 (1H, *d*, *J* = 7.3 Hz, H-1″), 3.20-3.40 (3H, *m*, H-2″, H-3″, H-4″), 3.81 (1H, *t*, *J* = 8.1 Hz, H-5″), 4.13 (1H, *dd*, *J* = 11.9/7.1 Hz, H_a-6″), 4.43 (1H, *d*, *J* = 10.6 Hz, H_b-6″), 7.34 (2H, *d*, *J* = 8.4 Hz, H-2‴, H-6‴), 6.64 (2H, *d*, *J* = 8.4 Hz, H-3‴, H-5‴), 6.30 (1H, *d*, *J* = 15.7 Hz, H-α), 7.46 (1H, *d*, *J* = 15.7 Hz, H-β); ^{13}C NMR (DMSO-d_6, 100 MHz): Table 2.

Acteoside (11): $C_{29}H_{36}O_{15}$ (mol.wt.: 624); ^{1}H NMR (CD_3OD, 400 MHz) and ^{13}C NMR (CD_3OD, 100 MHz): Table 3.

Table 2. ^{13}C NMR data of compounds **6-10**.

Atomic Number	**6**	**7**	**8**	**9**	**10**
Aglycone					
2	165.0	163.4	157.4	157.1	164.9
3	103.6	106.4	134.2	134.0	103.6
4	182.6	177.6	178.0	178.0	182.6
5	162.5	159.0	161.8	161.9	162.0
6	100.1	105.2	99.2	99.4	100.1
7	163.6	162.0	166.0	165.0	163.3
8	95.5	98.8	94.0	94.3	95.4
9	157.6	159.3	157.5	157.3	157.5
10	106.0	108.9	104.2	104.5	106.0
1′	121.3	122.1	121.8	121.8	121.6
2′	129.3	113.8	113.6	116.9	129.2
3′	116.7	146.3	147.2	145.4	116.6
4′	161.7	149.9	149.7	149.1	161.8
5′	116.7	116.6	114.9	115.9	116.6
6′	129.3	119.2	122.8	122.3	129.2
OCH_3			55.6		
Glucose					
1″	100.5	105.0	103.3	101.9	100.1
2″	73.7	74.3	74.7	74.7	73.6
3″	77.8	76.3	76.2	76.6	76.8
4″	70.2	70.4	70.4	70.6	70.6
5″	77.1	78.2	77.0	77.1	74.4
6″	61.2	61.5	67.4	67.6	64.0
Rhamnose					Acyl
1‴			101.3	101.4	125.5
2‴			70.8	71.0	130.7
3‴			71.1	71.2	116.3
4‴			72.6	72.5	160.4
5‴			68.6	68.9	116.3
6‴			16.7	18.4	130.7
α					114.4
β					145.6
C=O					167.1

Table 3. ^{1}H NMR (400 MHz, CD_3OD) and ^{13}C NMR (100 MHz, CD_3OD) data for compound **11**.

Atomic Number	DEPT	δ_C (ppm)	δ_H (ppm)	J (Hz)
Aglycone				
1	C	130.3		
2	CH	115.9	6.69 d	1.1
3	C	144.9		
4	C	143.4		
5	CH	115.3	6.67 d	7.7
6	CH	120.1	6.55 dd	7.7/1.1
α	CH_2	70.9	3.72 m 4.05 m	
β	CH_2	35.4	2.78 t	6.0
Glucose				
1′	CH	103.0	4.37 d	7.7
2′	CH	75.0	3.39 m	
3′	CH	80.5	3.81 t	9.2
4′	CH	69.4	4.92 t	9.5
5′	CH	74.8	3.55 m	
6a′ 6b′	CH_2	61.2	3.53 m 3.61 m	
Rhamnose				
1″	CH	101.9	5.18 d	1.1
2″	CH	71.2	3.91 m	
3″	CH	71.1	3.57 m	
4″	CH	72.6	3.30 m	
5″	CH	69.3	3.54 m	
6″	CH_3	17.3	1.08 d	6.2
Acyl moiety				
1‴	C	126.4		
2‴	CH	115.1	7.05 d	1.1
3‴	C	145.7		
4‴	C	148.8		
5‴	CH	114.0	6.77 d	7.7
6‴	CH	122.1	6.95 dd	7.7/1.1
α'	CH	113.4	6.27 d	15.7
β'	CH	146.9	7.59 d	15.7
C=O	C	167.2		

Chemical structures of compounds **1-11** were identified by comparing their spectral (UV, ^{1}H and, ^{13}C NMR) data with those reported in previous studies as: Lamiide (**1**)[3], ipolamiide (**2**)[4], ipolamiidoside (**3**)[5], 6β-hydroxyipolamiide (**4**)[6−7], 5-hydroxy-8-*epi*-loganin(**5**)[6−8], apigenin 7-*O*-β- glucopyranoside (**6**)[9], luteolin 5-*O*-β- glucopyranoside (**7**)[10], isorhamnetin 3-*O*-rutinoside (**8**)[11], quercetin 3-*O*-rutinoside (**9**)[12], apigenin 7-*O*-(6″-*O*-*trans*-*p*-coumaroyl) β- glucopyranoside (**10**)[13], and acteoside (**11**)[14], respectively.

Lamiide, ipolamiide, ipolamiidoside, 6β-hydroxyipolamiide, 5-hydroxy-8-*epi*-loganin, apigenin 7-*O*-β-glucopyranoside, luteolin 5-*O*-β-glucopyranoside, isorhamnetin 3-*O*-rutinoside, quercetin 3-*O*-rutinoside, apigenin 7-*O*-(6″-*O*-*trans*-*p*-coumaroyl) β- glucopyranoside, and acteoside were isolated for the first time from a *Wiedemannia* species.

Isolated compounds from *Wiedemannia orientalis* show different activities. Quercetin 3-*O*-rutinoside is known to possess antioxidant activity[15]. Lamiide showed anti-inflammatory activity and inhibited lipid peroxidation[16]. Ipolamiide showed anti-inflammatory activity[17]. Ipolamiidoside is reported to have antiviral activity[18]. Acteoside is shown to possess various activities such as anti-inflammatory[17], antioxidant[19], antimutagenic[19], anticarcinogenic[19], and neuroprotective effects[20]. Consequently, *Wiedemannia orientalis* can be a good source for various activities.

Acknowledgments

We thank the research foundation of Atatürk University (Grant No: 2005/146) for financially supporting this project.

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