HETEROCYCLES, Vol. 78, No. 4, 2009, pp. 1023 - 1029. © The Japan Institute of Heterocyclic Chemistry
Received, 4th October, 2008, Accepted, 27th November, 2008, Published online, 2nd December, 2008
DOI: 10.3987/COM-08-11568

MEDICINAL FLOWERS. XXV.[1] STRUCTURES OF FLORATHEASAPONIN J AND CHAKANOSIDE II FROM JAPANESE TEA FLOWER, FLOWER BUDS OF *CAMELLIA SINENSIS*

Sachiko Sugimoto, Masayuki Yoshikawa,* Seikou Nakamura, and Hisashi Matsuda

Kyoto Pharmaceutical University, Misasagi, Yamashina-ku, Kyoto 607-8412, Japan, e-mail address: myoshika@mb.kyoto-phu.ac.jp

Abstract — Following the investigation of floratheasaponins A, B, and C, a new acylated oleanane-type triterpene saponin termed floratheasaponin J and an aromatic glycoside called chakanoside II were isolated from the flower buds of Japanese tea plant (*Camellia sinensis*). The structures of the new glycosides were determined by chemical and physicochemical evidence.

The flower buds of *Camellia sinensis* (L.) O. KUNTZE (*C. sinensis* var. sinensis, Theaceae) have been used as a food garnish in Japanese-style dishes: e.g. "botebotecha" in Shimane prefecture. However, the chemical constituents and pharmacological properties of the flower buds of *C. sinensis* have yet not been characterized. In the course of our characterization studies on the bioactive constituents from medicinal flowers[2-9] and *Camellia* plants,[10-17] we have reported the isolation and structure elucidation of floratheasaponins A, B, and C from the flower buds of Japanese *C. sinensis*.[18] Those floratheasaponins were found to show inhibitory effects on serum triglyceride elevation in olive oil-treated mice,[18] on ethanol- and indomethacin-induced gastric mucosal lesions in rats,[19] and on serum glucose elevation in sucrose-loaded rats.[19] From the flower buds of Chinese tea plant cultivated in Anhui and Fujian provinces, floratheasaponins D,[5] E,[5] F,[5] G,[5] H,[5] and I[5] and chakasaponins I,[8] II,[8] and III[8] were isolated together with floratheasaponins A, B, and C and they showed inhibitory activities on the release of β-hexosaminidase from RBL-2H3 cells,[5] accelerating effects on gastrointestinal transit,[8] and inhibitory effects against pancreatic lipase.[8] Recently, we isolated chakasaponins V and VI, chakanoside I, and chakaflavonoside A from the flower buds of *C. sinensis* cultivated in Sichuan and Fujian provinces of China and reported their structure.[20] In this paper, we describe the isolation and structure elucidation of a new acylated oleanane-type triterpene saponin called floratheasaponin J (**1**) and an aromatic glycoside named chakanoside II (**2**) from Japanese tea flower.

The 1-BuOH-soluble fraction (15.8%) from the flower buds of Japanese tea plant cultivated in Shiga prefecture of Japan was subjected to normal- and reversed- phase silica gel column chromatography to give fractions 5-3 (0.12%) and 6-5 (1.36%).[18] Fractions 5-3 and 6-5 were further separated by HPLC to furnish floratheasaponin J (**1**, 0.034%) and chakanoside II (**2**, 0.023%).

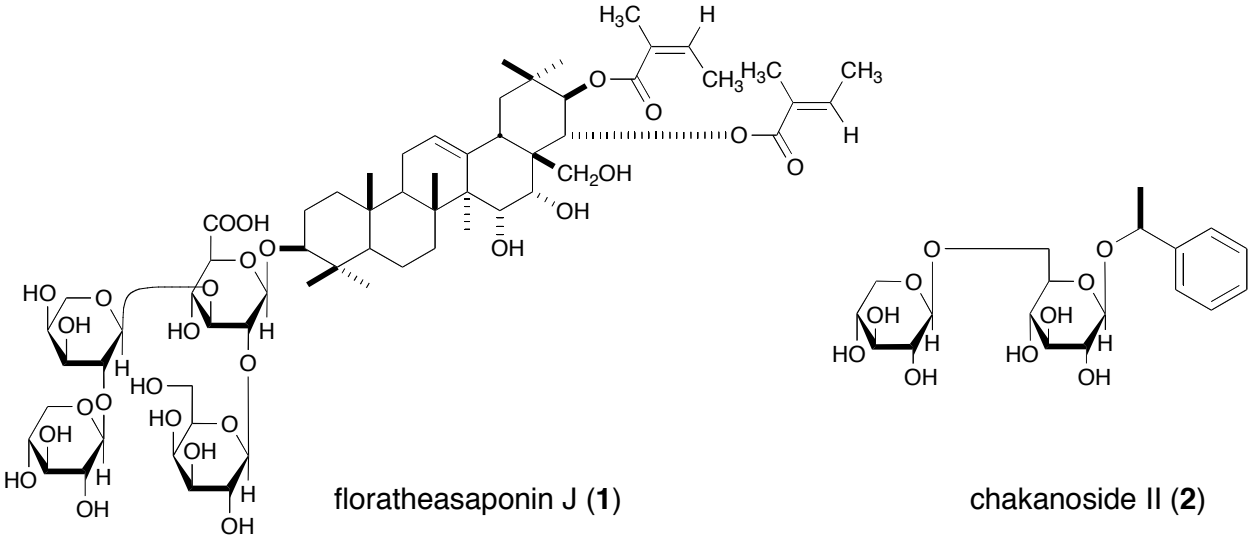


Chart 1. New Constituents from the Flower Buds of Japanese *Camellia sinensis*

Structures of Floratheasaponin J and Chakanoside II

Floratheasaponin J (**1**) was isolated as colorless fine crystals from $CHCl_3$-MeOH with mp 207.0-210.0 °C and negative optical rotation ($[\alpha]_D^{21}$ –7.3° in MeOH). The IR spectrum of **1** showed absorption bands at 1718 and 1647 cm^{-1} ascribable to carbonyl and olefin functions and broad bands at 3470, 1078, and 1048 cm^{-1}, suggestive of an oligoglycoside structure. In the positive-ion matrix-assisted laser desorption/ionization (MALDI)-MS of **1**, a quasimolecular ion peak was observed at *m/z* 1295 $(M+Na)^+$ and high-resolution positive-ion MALDI-MS analysis revealed the molecular formula of **1** to be $C_{62}H_{96}O_{27}$. Alkaline hydrolysis of **1** with a mixture of 10% aqueous KOH and 50% aqueous 1,4-dioxane (1:1, v/v) gave desacyl-floratheasaponin B (**1a**)[18] together with angelic acid and tiglic acid, which were identified by HPLC analysis of the corresponding 4-nitrobenzyl derivatives.[5,8,9]

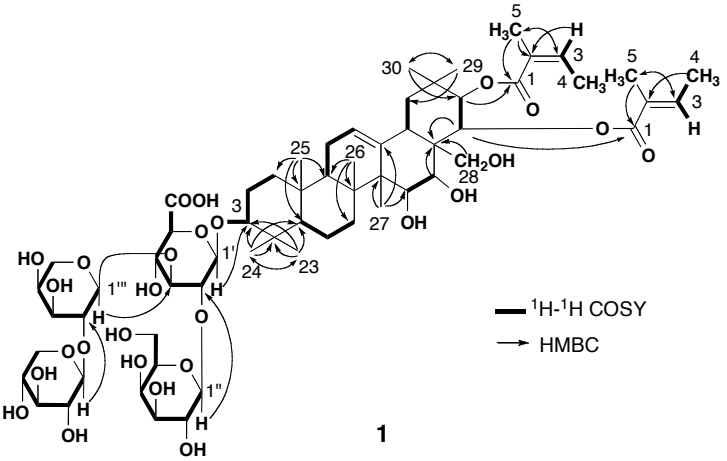


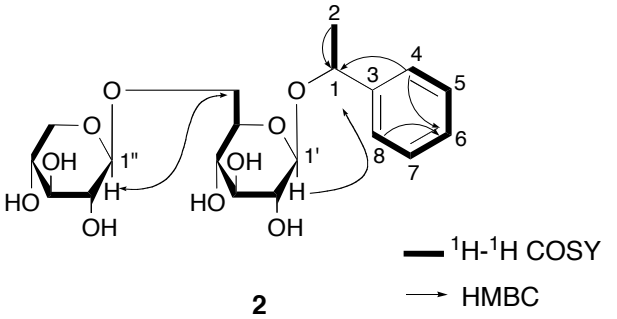
Figure 1. Significant ^1H-^1H COSY and HMBC Correlations for **1**

The ^1H- (pyridine-d_5) and ^{13}C-NMR (Table 1) spectra of **1**, which were assigned by various NMR experiments,[21] showed signals due to a desacyl-floratheasaponin B part [δ 0.81, 0.99, 1.10, 1.12, 1.24, 1.33, 1.84 (3H each, all s, H_3-25, 26, 29, 24, 23, 30, 27), 3.23 (1H, br d, *J*=ca. 11 Hz, H-3), 4.20 (1H, m,

H-16), 4.42 (1H, n, H-15), 5.50 (1H, br s, H-12), 6.36 (1H, d, *J*=10.5 Hz, H-22), 6.67 (1H, d, *J*=10.5 Hz, H-21), 4.90 (1H, d, *J*=7.5 Hz, H-1'), 5.00 (1H, d, *J*=7.6 Hz, H-1""), 5.70 (1H, d, *J*=6.7 Hz, H-1"), 5.78 (1H, d, *J*=7.2 Hz, H-1'")], an angeloyl [δ 1.72 (3H, s, Ang-5), 1.96 (3H, d, *J*=7.0 Hz, Ang-4), 5.73 (1H, dq-like, Ang-3)], and a tigloyl [δ 1.61 (3H, d, *J*=6.5 Hz, Tig-4), 1.91 (3H, s, Tig-5), 7.07 (1H, dq-like, Tig-3)]. The positions of the two acyl groups in **1** were elucidated on the basis of HMBC experiment (Figure 1). Thus, long-range correlations were observed between the 21-proton and carbonyl carbon of the angeloyl group (δc 168.2, C-1) and between the 22-proton and the carbonyl carbon of the tigloyl group (δc 167.9, C-1). Consequently, the structure of floratheasaponin J was determined to be 21-*O*-angeloyl-22-*O*-tigloyl-R_1-barrigenol 3-*O*-[β-D-galactopyranosyl(1–2)][β-D-xylopyranosyl (1–2)-α-L-arabinopyranosyl(1–3)]-β-D-glucuronopyranoside (**1**).

Table 1. ^{13}C-NMR (150 MHz, pyridine-d_5) data of **1**

C-	**1**	*C*-	**1**
1	38.9	22-*O*-Tig	
2	26.6	1	167.9
3	89.4	2	129.4
4	39.5	3	137.1
5	55.5	4	14.1
6	18.8	5	12.4
7	36.7		
8	41.4	GlcA	
9	47.0	1'	105.5
10	36.9	2'	79.1
11	23.9	3'	83.9
12	125.4	4'	71.1
13	143.6	5'	77.2
14	48.3	6'	172.3
15	73.7	Gal	
16	67.5	1"	103.4
17	47.7	2"	73.7
18	40.9	3"	75.1
19	46.9	4"	70.1
20	36.5	5"	76.4
21	79.0	6"	61.9
22	73.3	Ara	
23	27.9	1'"	101.6
24	16.8	2'"	81.9
25	15.5	3'"	73.3
26	17.5	4'"	68.3
27	21.2	5'"	65.8
28	63.0	Xyl	
29	29.5	1""	106.8
30	20.0	2""	75.7
21-*O*-Ang		3""	78.2
1	168.2	4""	70.8
2	129.2	5""	67.5
3	136.9		
4	15.8		
5	20.6		



2

Figure 2. Significant ^{1}H-^{1}H COSY and HMBC Correlations for **2**

Chakanoside II (**2**) was also isolated as a white powder with negative optical rotation ($[\alpha]_D^{23}$ –81.5° in MeOH). The IR spectrum of **2** showed broad absorption bands at 3354, 1078, and 1040 cm^{-1} due to a glycoside structure. The positive-ion fast atom bombardment (FAB)-MS of **2** showed a quasimolecular ion peak at *m/z* 439 $(M+Na)^+$, while the negative-ion FAB-MS showed a quasimolecular ion peak at *m/z* 415 $(M-H)^-$ together with a fragment ion peak at *m/z* 283 $(M-C_5H_8O_4)^-$. The high-resolution positive-ion FAB-MS analysis revealed the molecular formula of **2** to be $C_{19}H_{28}O_{10}$. Acid hydrolysis of **2** with 1.0 M aqueous HCl liberated D-glucose and D-xylose, which were identified by HPLC analysis using an optical rotation detector.[5,8,9] The ^{1}H- (pyridine-d_5) and ^{13}C-NMR (Table 2) spectra[21] of **2** showed signals assignable to a phenyl ethanol part [δ 1.53 (3H, d, *J*=6.6 Hz, H-2), 5.50 (1H, q, *J*=ca. 7 Hz, H–1), 7.25 (1H, m, H-6), 7.32 (2H, dd-like, H-5, 7), 7.73 (2H, d, *J*=7.9 Hz, H-4, 8)] together with a β-D-glucopyranosyl [δ 4.74

(1H, d, *J*=7.4 Hz, H-1')] and a *β*-D-xylopyranosyl [*δ* 5.08 (1H, d, *J*=7.2 Hz, H-1'')] moieties. The oligoglycoside structure of **2** was characterized by HMBC experiment, which showed long-range correlations between the anomeric proton of the D-xylopyranosyl moiety and the 6'-methylene carbon of the D-glucopyranosyl moiety and between the anomeric proton of the D-glucopyranosyl moiety and the 1-carbon of the aglycon part. Finally, enzymatic hydrolysis of **2** with naringinase in 0.2 M acetate buffer yielded 1-(*S*)-phenyl ethanol (**2a**). On the basis of those findings, the structure of chakanoside II (**2**) was determined as shown.

Table 2. ^{13}C-NMR (125 MHz, pyridine-d_5) data of **2**

C-	**2**	*C*-	**2**
1	74.6	Glc	
2	24.9	1'	101.4
3	143.9	2'	75.1
4	127.1	3'	78.3
5	128.5	4'	71.6
6	127.4	5'	77.1
7	128.4	6'	69.6
8	127.1	Xyl	
		1"	105.8
		2"	74.9
		3"	78.2
		4"	71.0
		5"	67.1

In conclusion, a new acylated oleanane-type triterpene saponin, floratheasaponin J (**1**), and an aromatic glycoside, chakanoside II (**2**), were isolated from the flower buds of Japanese tea plant and their structures were determined on the basis of chemical and physicochemical evidence.

EXPERIMENTAL

The following instruments were used to obtain physical data: specific rotations, Horiba SEPA-300 digital polarimeter (*l* = 5 cm); IR spectra, Shimadzu FTIR-8100 spectrometer; MALDI-MS and high-resolution MS, Applied Biosystems Voyager-DE STR; FAB-MS and high-resolution MS, JEOL JMS-SX 102A mass spectrometer; ^{1}H-NMR spectra, JEOL EX-270 (270 MHz), JNM-LA500 (500 MHz), and JEOL ECA-600K (600 MHz) spectrometers; ^{13}C-NMR spectra, JEOL EX-270 (68 MHz) JNM-LA500 (125 MHz), and JEOL ECA-600K (150 MHz) spectrometers with tetramethylsilane as an internal standard; and HPLC detectors, Shimadzu RID-6A refractive index and SPD-10A*vp* UV-VIS detectors. HPLC column, YMC–Pack ODS–A (250 x 4.6 mm i.d.) and (250 x 20 mm i.d.) columns were used for analytical and preparative purposes, respectively.

The following experimental conditions were used for chromatography: ordinary-phase silica gel column chromatography, Silica gel BW-200 (Fuji Silysia Chemical, Ltd., 150–350 mesh); reverse-phase silica gel column chromatography, Chromatorex ODS DM1020T (Fuji Silysia Chemical, Ltd., 100–200 mesh); TLC, precoated TLC plates with Silica gel 60F_{254} (Merck, 0.25 mm) (ordinary phase) and Silica gel RP-18 F_{254S} (Merck, 0.25 mm) (reverse phase); reversed-phase HPTLC, precoated TLC plates with Silica gel RP-18 WF_{254S} (Merck, 0.25 mm); and detection was achieved by spraying with 1% $Ce(SO_4)_2$–10% aqueous H_2SO_4 followed by heating.

Isolation of Floratheasaponin J (1) and Chakanoside II (2)

The dried flower buds of *C. sinensis* (1.1 kg) were finely cut and extracted three times with MeOH (10 L) under reflux for 3 h. Evaporation of the solvent under reduced pressure provided a methanolic extract

(375 g, 34.1% from the flowers), and the methanolic extract (300 g) was partitioned into an EtOAc–H_2O (1:1, v/v) mixture to furnish an EtOAc-soluble fraction (43.7 g, 5.0%) and an aqueous phase. The aqueous phase was further extracted with 1-BuOH to give a 1-BuOH-soluble fraction (139.2 g, 15.8%) and an H_2O-soluble fraction (117.1 g, 13.3%). The 1-BuOH-soluble fraction (95.2 g) was subjected to normal-phase silica gel column chromatography [3.0 kg, $CHCl_3$–MeOH–H_2O (10:3:1, lower layer → 7:3:1, lower layer → 6:4:1, v/v/v) → MeOH] to give ten fractions [Fr. 1 (0.45 g), Fr. 2 (6.38 g), Fr. 3 (0.48 g), Fr. 4 (3.85 g), Fr. 5 (9.82 g), Fr. 6 (35.20 g), Fr. 7 (5.40 g), Fr. 8 (6.25 g), Fr. 9 (9.24 g), and Fr. 10 (14.80 g)]. Fraction 5 (9.82 g) was subjected to reversed-phase silica gel column chromatography [240 g, MeOH–H_2O (20:80 → 30:70 → 50:50 → 70:30, v/v) → MeOH] to afford eight fractions [Fr. 5-1 (1.44 g), Fr. 5-2 (1.29 g), Fr. 5-3 (1.05 g), Fr. 5-4 (0.83 g), Fr. 5-5 (0.40 g), Fr. 5-6 (0.33 g), Fr. 5-7 (0.31 g), and Fr. 5-8 (1.40 g)]. Fraction 5-3 (500 mg) was purified by HPLC [MeOH–H_2O (35:65, v/v)] to furnish chakanoside II (**2**, 55.4 mg, 0.023%). Fraction 6 (35.2 g) was subjected to reversed-phase silica gel column chromatography [700 g, MeOH–H_2O (50:50 → 70:30, v/v) → MeOH] to afford six fractions [Fr. 6-1 (2.56 g), Fr. 6-2 (0.23 g), Fr. 6-3 (2.16 g), Fr. 6-4 (0.40 g), Fr. 6-5 (12.00 g), and Fr. 6-6 (1.23 g)]. Fraction 6-5 (1.0 g) was further separated by HPLC [MeOH–1% aqueous acetic acid (75:25, v/v)] to furnish Fr. 6-5-3 (60.3 mg). Fr. 6-5-3 (60.3 mg) was purified by HPLC [MeOH–1% aqueous acetic acid (75:25, v/v)] to give floratheasaponin J (**1**, 16.8 mg, 0.034%).

Floratheasaponin J (**1**): Colorless fine crystals from $CHCl_3$–MeOH, mp 207.0–210.0°C, $[\alpha]_D^{21}$ –7.3° (*c* 0.87, MeOH). IR (KBr): ν_{max} 3470, 2980, 1718, 1647, 1078, 1048 cm^{-1}. High-resolution positive-ion MALDI-MS: Calcd for $C_{62}H_{96}O_{27}Na$ $(M+Na)^+$: 1295.6031. Found: 1295.6023. ^{1}H-NMR (600 MHz, pyridine-d_5) δ: 0.81, 0.99, 1.10, 1.12, 1.24, 1.33, 1.84 (3H each, all s, H_3-25, 26, 29, 24, 23, 30, 27), 1.61 (3H, d, *J*=6.5 Hz, H_3-22-*O*-Tig-4), 1.72 (3H, s, H_3-21-*O*-Ang-5), 1.91 (3H, s, H_3-22-*O*-Tig-5), 1.96 (3H, d, *J*=7.0 Hz, H_3-21-*O*-Ang-4), 3.23 (1H, br d, *J*=ca. 11 Hz, H-3), 3.40, 3.58 (1H each, both br d, *J*=ca. 11 Hz, H_2-28), 4.20 (1H, m, H-16), 4.42 (1H, m, H-15), 4.90 (1H, d, *J*=7.5 Hz, H-1'), 5.00 (1H, d, *J*=7.6 Hz, H-1''''), 5.50 (1H, br s, H-12), 5.70 (1H, d, *J*=6.7 Hz, H-1''), 5.73 (1H, dq-like, H-21-*O*-Ang-3), 5.78 (1H, d, *J*=7.2 Hz, H-1'''), 6.36 (1H, d, *J*=10.5 Hz, H-22), 6.67 (1H, d, *J*=10.5 Hz, H-21), 7.07 (1H, dq-like, H-22-*O*-Tig-3), ^{13}C-NMR (150 MHz, pyridine-d_5) δ_c: given in Table 1. Positive-ion MALDI-MS: *m/z* 1295 $(M+Na)^+$.

Chakanoside II (**2**): a white powder, $[\alpha]_D^{23}$ –81.5° (*c* 0.50, MeOH). IR (KBr): ν_{max} 3354, 2930, 1456, 1373, 1078, 1040 cm^{-1}. High-resolution positive-ion FAB-MS: Calcd for $C_{19}H_{28}O_{10}Na$ $(M+Na)^+$: 439.1580. Found: 439.1573. negative-ion FAB-MS *m/z* 415 $(M-H)^-$, 283 $(M-C_5H_8O_4)^-$; ^{1}H-NMR (500 MHz, pyridine-d_5) δ: 1.53 (3H, d, *J*=6.6 Hz, H–2), 4.74 (1H, d, *J*=7.4 Hz, H–1'), 5.08 (1H, d, *J*=7.2 Hz, H–1''), 5.50 (1H, q, *J*=ca. 7 Hz, H–1), 7.25 (1H, m, H–6), 7.32 (2H, dd-like, H–5, 7), 7.73 (2H, d, *J*=7.9 Hz, H–4, 8), ^{13}C-NMR (125 MHz, pyridine-d_5) δ_c: given in Table 2. Positive-ion FAB-MS: *m/z* 439 $(M+Na)^+$.

Alkaline Hydrolysis of Floratheasaponin J (1)

A solution of floratheasaponin J (**1**) (3.0 mg) in 50% aqueous 1,4-dioxane (0.5 mL) was treated with 10% aqueous KOH (0.5 mL) and the whole was stirred at 37 °C for 1 h. The reaction mixture was neutralized

with Dowex HCR W2 (H^+ form) and the resin was removed by filtration. Evaporation of the solvent from the filtrate under reduce pressure yielded a reaction product. A small part of the reaction product was dissolved in $(CH_2)_2Cl_2$ (2 mL) and the solution was treated with *p*-nitrobenzyl-*N,N'*-diisopropylisourea (10 mg), then the whole was stirred at 80 °C for 1 h. The reaction solution was subjected to HPLC analysis [column: YMC–Pack ODS–A, 250 x 4.6 mm i.d.; mobile phase: MeCN–H_2O (50:50, v/v); detection: UV (254 nm); flow rate: 1.0 mL/min; column temperature: rt] to identify the *p*-nitrobenzyl esters of tiglic acid (t_R 24.4 min) and angelic acid (t_R 27.1 min) from **1**. The rest of the reaction product was subjected to normal-phase silica gel column chromatography [50 mg, $CHCl_3$–MeOH–H_2O (10:3:1 lower layer→6:4:1)] to give desacyl-floratheasaponin B (1.2 mg). The desacyl derivative (**1a**) was identical with an authentic sample from floratheasaponin B[18] by HPLC analysis [column: YMC–Pack ODS–A, 250 x 4.6 mm i.d.; mobile phase: MeOH–H_2O (55:45, v/v); detection: RID-6A refractive index; flow rate: 0.7 mL/min; column temperature: room temperature], and ^1H- (C_5D_5N) and FAB-MS spectra comparisons.

Acid Hydrolysis of Chakanoside II (2)

A solution of **2** (1 mg) in 1.0 M HCl (1.0 mL) was heated under reflux for 3 h. After cooling, the reaction mixture was poured into ice-water and neutralized with Amberlite IRA–400 (OH^- form), and the resin was removed by filtration. Then, the filtrate was extracted with EtOAc. The aqueous layer was subjected to HPLC analysis under the following conditions: HPLC column, Kaseisorb LC NH_2–60–5, 4.6 mm i.d. x 250 mm (Tokyo Kasei Co., Ltd., Tokyo, Japan); detection, optical rotation [Shodex OR-2 (Showa Denko Co., Ltd., Tokyo, Japan)]; mobile phase, MeCN–H_2O (75:25, v/v); flow rate 0.80 mL/min; column temperature, rt. Identification of D-glucose and D-xylose present in the aqueous layer was carried out by comparison of their retention times and optical rotations with those of authentic samples. t_R: 8.6 min (D-glucose, positive optical rotation) and 6.6 min (D-xylose, positive optical rotation).

Enzymatic Hydrolysis of Chakanoside II (2)

A solution of **2** (3.2 mg) of 0.2 M acetate buffer (1.0 mL, pH 3.8) was treated with naringinase (10.4 mg, from *Aspergillus*, Wako Pure Chemical Ind., Osaka, Japan) and kept stirring at 37 ºC for 4 h. The reaction mixture was treated with EtOH (1.0 mL) and then centrifuged at 4,000 rpm for 10 min. The supernatant solution was concentrated under reduced pressure to give 1-(*S*)-phenylethanol, which was identified by HPLC analysis {column: YMC–Pack ODS–A, 250 x 4.6 mm i.d.; mobile phase: MeOH–H_2O (40:60, v/v); detection: optical rotation [Shodex OR-2 (Showa Denko Co., Ltd., Tokyo, Japan)]; flow rate: 0.55 mL/min}; column temperature: room temperature} in direct comparison with those of authentic samples [1-(*S*) and 1-(*R*)-phenylethanol (Wako Pure Chemical Ind., Osaka, Japan)].

REFERENCES AND NOTES

1. Part XXIV: S. Nakamura, Y. Okazaki, K. Ninomiya, T. Morikawa, H. Matsuda, and M. Yoshikawa, *Chem. Pharm. Bull.*, 2008, **56**, in press.
2. M. Yoshikawa, F. Xu, T. Morikawa, Y. Pongpiriyadacha, S. Nakamura, Y. Asao, and A. Kumahara,

and H. Matsuda, *Chem. Pharm. Bull.*, 2007, **55**, 308.
3. S. Nakamura, S. Sugimoto, H. Matsuda, and M. Yoshikawa, *Heterocycles*, 2007, **71**, 577.
4. M. Yoshikawa, S. Sugimoto, S. Nakamura, and H. Matsuda, *Chem. Pharm. Bull.*, 2007, **55**, 571.
5. M. Yoshikawa, S. Nakamura, Y. Kato, K. Matsuhira, and H. Matsuda, *Chem. Pharm. Bull.*, 2007, **55**, 598.
6. M. Yoshikawa, T. Morikawa, Y. Asao, E. Fujiwara, S. Nakamura, and H. Matsuda, *Chem. Pharm. Bull.*, 2007, **55**, 606.
7. M. Yoshikawa, S. Sugimoto, S. Nakamura, H. Sakumae, and H. Matsuda, *Chem. Pharm. Bull.*, 2007, **55**, 1034.
8. M. Yoshikawa, S. Sugimoto, Y. Kato, S. Nakamura, T. Wang, C. Yamashita, and H. Matsuda, *Chem. Biodiv.*, 2008, **5**, in press.
9. Y. Xie, T. Morikawa, K. Ninomiya, K. Imura, O. Muraoka, D. Yuan, and M. Yoshikawa, *Chem. Pharm. Bull.*, **56**, in press.
10. T. Murakami, J. Nakamura, H. Matsuda, and M. Yoshikawa, *Chem. Pharm. Bull.*, 1999, **47**, 1759.
11. T. Murakami, J. Nakamura, T. Kageura, H. Matsuda, and M. Yoshikawa, *Chem. Pharm. Bull.*, 2000, **48**, 1720.
12. M. Yoshikawa, T. Morikawa, N. Li, A Nagatomo, X. Li, and H. Matsuda, *Chem. Pharm. Bull.*, 2005, **53**, 1559.
13. T. Morikawa, H. Matsuda, N. Li, S. Nakamura, X. Li, and M. Yoshikawa, *Heterocycles*, 2006, **68**, 1139.
14. M. Yoshikawa, T. Morikawa, S. Nakamura, N. Li, X. Li, and H. Matsuda, *Chem. Pharm. Bull.*, 2007, **55**, 57.
15. T. Morikawa, S. Nakamura, Y. Kato, O. Muraoka, H. Matsuda, and M. Yoshikawa, *Chem. Pharm. Bull.*, 2007, **55**, 293.
16. N. Li, T. Morikawa, H. Matsuda, K. Ninomiya, X. Li, and M. Yoshikawa, *Heterocycles*, 2007, **71**, 1193.
17. T. Morikawa, H. Matsuda, N. Li, X. Li, and M. Yoshikawa, *Helv. Chim. Acta*, 2007, **90**, 2342.
18. M. Yoshikawa, T. Morikawa, K. Yamamoto, Y. Kato, A. Nagatomo, and H. Matsuda, *J. Nat. Prod.*, 2005, **68**, 1360.
19. M. Yoshikawa, T. Wang, S. Sugimoto, S. Nakamura, A. Nagatomo, H. Matsuda, and S. Harima, *Yakugaku Zasshi*, 2008, **128**, 141.
20. M. Yoshikawa, S. Sugimoto, S. Nakamura, and H. Matsuda, *Chem. Pharm. Bull.*, **56**, in press.
21. The ^{1}H- and ^{13}C-NMR spectra of **1** and **2** were assigned with the aid of distortionless enhancement by polarization transfer (DEPT), homocorrelation spectroscopy (^{1}H–^{1}H COSY), heteronuclear multiple quantum coherence (HMQC), and heteronuclear multiple bond connectivity (HMBC) experiments.