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Iridoid Glucosides from *Lonicera japonica* THUNB.

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A new iridoid glucoside, epi-vogeloside (**4**), was isolated along with secologanin dimethylacetal (**1**), loganin (**2**) and vogeloside (**3**) from *Lonicera japonica* THUNB. The structure of the new compound was determined on the basis of physicochemical evidence.

Keywords——*Lonicera japonica*; Caprifoliaceae; iridoid glucoside; secologanin dimethylacetal; loganin; vogeloside; epi-vogeloside

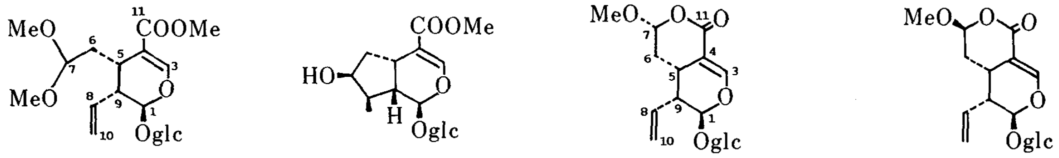
From the hot water extract of aerial parts of *Lonicera japonica* THUNB. (Caprifoliaceae), a new iridoid glucoside, epi-vogeloside (**4**), was isolated along with three known compounds, secologanin dimethylacetal (**1**), loganin (**2**) and vogeloside (**3**). The structure of the new compound was determined on the basis of spectral evidence.

The proton nuclear magnetic resonance (^{1}H-NMR) and carbon-13 nuclear magnetic resonance (^{13}C-NMR) spectra of **1** showed the characteristic signals of an iridoid glycoside. In the fast atom bombardment mass spectrum (FAB-MS), a fragment (*m/z* 403, MH$^+$ − MeOH) was observed, and from the ^{13}C-NMR spectrum, the molecular formula of **1** was determined to be $C_{19}H_{30}O_{11}$. In the ^{13}C-NMR spectrum, the signals of a glucosyl moiety, the signals of two acetal carbons (δ 97.3, 100.6) and the signals of three methoxyl groups were observed. These data indicated that **1** is secologanin dimethylacetal[1]; this is the first report of its isolation from a natural source.

The ^{1}H- and ^{13}C-NMR spectra of **2** showed that **2** is an iridoid glycoside. The ^{13}C-NMR spectrum showed the presence of a glucosyl group, an acetal group and a carbon (δ 73.5) linked to oxygen. These facts indicated that **2** is loganin.[2-4]

The ^{1}H- and ^{13}C-NMR spectra of **3** showed that **3** is a secoiridoid glycoside. In the FAB-MS of **3**, a pseudo-molecular ion (*m/z* 389, MH$^+$) was observed, and from the ^{13}C-NMR spectrum, the molecular formula of **3** was determined to be $C_{17}H_{24}O_{10}$. In the ^{13}C-NMR spectrum, the signals of a glucosyl group, the carbons of a vinyl group (δ 120.4, 132.2), the C-1 carbon (δ 98.3) and a carbon bearing two oxygens (δ 103.6), were observed. From these facts, **3** was determined to be vogeloside,[5] and this was confirmed by direct comparison with an authentic sample.

Compound **4**, mp 111—112 °C, $[\alpha]_D$ −125 °, also gave a pseudo-molecular ion (*m/z* 389, MH$^+$) on FAB-MS. The molecular formula of **4** was supposed to be $C_{17}H_{24}O_{10}$, and this was



1 **2** **3** **4**

Chart 1

supported by the ^{13}C-NMR spectrum. The ^{1}H-NMR spectrum of **4** showed the presence of a methoxyl group (δ 3.10) and a characteristic olefin proton at C-3 (δ 7.75, $J=2.2$ Hz), as found in **3**. The ^{13}C-NMR spectrum of **4** gave almost the same chemical shifts as that of **3** except for the signals due to C-5, C-6 and C-7. The signals at C-5, C-6 and C-7 of **4** were observed at higher fields (2.3, 1.4 and 1.8 ppm, respectively) than those of **3**. From these data, **4** was suggested to be the C-7 epimer of **3**, and was named epi-vogeloside.

Experimental

All melting points were determined on a Yanagimoto micro melting point apparatus and are uncorrected. Infrared (IR) spectra were recorded on a JASCO A-202 grating infrared spectrometer. Optical rotations were recorded on a JASCO DIP-140 digital polarimeter. ^{1}H- and ^{13}C-NMR spectra were recorded on a JEOL JNM-FX-90Q NMR spectrometer with tetramethylsilane as an internal standard (δ value, ppm). FAB-MS were recorded on JEOL JMS-DX303 mass spectrometer. Thin layer chromatography (TLC) was performed on precoated Silica gel 60F$_{254}$ plates (Merck).

Isolation——The fresh aerial parts of *Lonicera japonica* THUNB. (2.7 kg) were extracted with hot water. The extract was passed through a Diaion HP-20 (Mitsubishi Chemical Ind. Ltd.) column, and the eluate with 50% aqueous methanol was concentrated under reduced pressure. The residual extract (29 g) was repeatedly chromatographed on silica gel columns with chloroform–methanol gradient solvent systems, to give four iridoid glucosides.

Secologanin Dimethylacetal (1)——White powder (500 mg). FAB-MS *m*/*z*: 403 (MH^{+} − MeOH) ($C_{18}H_{27}O_{10}$). $[\alpha]_D$ −108.1° ($c=1.0$, MeOH). ^{1}H-NMR (pyridine-d_5): 3.07 (6H, s, OCH$_3$), 3.38 (3H, s, OCH$_3$-11), 5.65 (1H, d, $J=4.8$ Hz, H-1), 7.46 (1H, s, H-3). ^{13}C-NMR data are given in Table I.

Loganin (2)——Colorless needles (910 mg). mp 222—223 °C (MeOH). IR $\gamma_{\max}^{\mathrm{KBr}}$ cm^{-1}: 3550, 3300, 1715, 1650, 1440, 1300, 1070, 1040, 860. $[\alpha]_D$ −85.1° ($c=1.2$, MeOH). ^{1}H-NMR (pyridine-d_5): 0.99 (3H, d, $J=6.5$ Hz, CH$_3$-10), 3.38 (3H, s, OCH$_3$-11), 5.17 (1H, d, $J=7.4$ Hz, H-7), 5.45 (1H, d, $J=4.4$ Hz, H-1), 7.47 (1H, s, H-3). ^{13}C-NMR data are given in Table I.

Vogeloside (3)——White powder (250 mg). FAB-MS *m*/*z*: 389 (MH^{+}) ($C_{17}H_{25}O_{10}$). $[\alpha]_D$ −208° ($c=0.8$, MeOH). ^{1}H-NMR (pyridine-d_5): 3.25 (3H, s, OCH$_3$-7). 7.71 (1H, d, $J=2.4$ Hz, H-3). ^{13}C-NMR data are given in Table I.

Epi-vogeloside (4)——Colorless needles (130 mg). mp 111—112 °C (MeOH). FAB-MS *m*/*z*: 389 (MH^{+}) ($C_{17}H_{25}O_{10}$). IR $\gamma_{\max}^{\mathrm{KBr}}$ cm^{-1}: 3450, 1700, 1620, 1270, 1210, 1050, 910, 830. $[\alpha]_D$ −125° ($c=0.7$, MeOH). ^{1}H-NMR (pyridine-d_5): 3.10 (3H, s, OCH$_3$-7), 7.75 (1H, d, $J=2.2$ Hz, H-3). ^{13}C-NMR data are given in Table I.

TABLE I. ^{13}C-NMR Data for **1**—**4** (Pyridine-d_5)

	1	**2**	**3**	**4**
C-1	97.3 (d)	97.6 (d)	98.3 (d)	98.1 (d)
C-3	152.4 (d)	151.3 (d)	152.8 (d)	153.0 (d)
C-4	110.9 (s)	113.3 (s)	104.4 (s)	104.9 (s)
C-5	28.8 (d)	31.8 (d)	24.7 (d)	22.4 (d)
C-6	32.6 (t)	42.9 (t)	30.9 (t)	29.5 (t)
C-7	100.6 (d)	73.5 (t)	103.6 (d)	101.8 (d)$^{a)}$
C-8	135.1 (d)	41.7 (d)	132.2 (d)	132.7 (d)
C-9	44.5 (d)	46.1 (d)	42.8 (d)	42.9 (d)
C-10	119.1 (t)	13.9 (q)	120.4 (t)	120.4 (t)
C-11	167.4 (s)	167.7 (s)	164.5 (s)	164.5 (s)
Me	51.0 (q)$^{a)}$ 52.0 (q)$^{a)}$ 53.0 (q)$^{a)}$	50.9 (q)	56.5 (q)	56.5 (q)
glc-1	103.4 (d)	108.8 (d)	100.4 (d)	101.0 (d)$^{a)}$
glc-2	74.6 (d)	74.8 (d)	74.9 (d)	74.6 (d)
glc-3	78.4 (d)	78.5 (d)	78.4 (d)	78.5 (d)
glc-4	71.5 (d)	71.6 (d)	71.4 (d)	71.4 (d)
glc-5	78.8 (d)	78.8 (d)	78.9 (d)	78.9 (d)
glc-6	62.6 (t)	62.7 (t)	62.5 (t)	62.6 (t)

a) Assignments may be interchangeable within the same column. Abbreviation: glc, β-D-glucopyranosyl.

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