HETEROCYCLES, Vol 27, No. 5, 1988

# STUDIES ON ACONITUM SPECIES VI.[1] YESOLINE, A NEW $C_{20}$-DITERPENOID ALKALOID FROM *ACONITUM YESOENSE* VAR. *MACROYESOENSE* (NAKAI) TAMURA.

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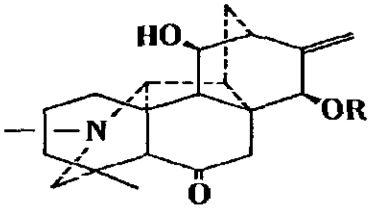
*Abstract* — A new $C_{20}$-diterpenoid alkaloid, yesoline, and a known alkaloid, 14-dehydrodelcosine were isolated from *Aconitum yesoense* var. *macroyesoense* (Nakai) Tamura. Structure of the new alkaloid was determined by means of spectral and chemical methods.

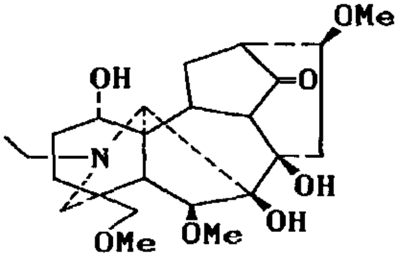
The isolation and structure elucidation of fourteen $C_{20}$-diterpenoid alkaloids and five $C_{19}$-diterpenoid alkaloids from *Aconitum yesoense* var. *macroyesoense* (Nakai) Tamura were reported in our previous paper.[1] Our continued investigations on the constituents of this plant now resulted in the isolation of a new diterpenoid alkaloid, yesoline (1), and a known alkaloid, 14-dehydrodelcosine (2).[2]

Alkaloid 2 was identified by comparison of the spectral data with those in literature.[2]

The $^1H$-nmr spectrum of yesoline (1), $C_{30}H_{37}NO_8$, showed signals due to four methyl groups assignable to $C-CH_3$, $N-CH_3$, and two $OCH_3$, signals due to two methines and typical 1,2,4-trisubstituted benzene (See Experimental). The $^1H$-nmr, ir, uv, and mass spectral data suggested the presence of veratroyloxy group as an ester. The $^1H$-nmr signals at $\delta$ 5.23 and 5.41 (each 1H, s, $C=CH_2$), and $^{13}C$-nmr signals at 144.5 ppm (s, C-16) and 117.1 ppm (t, C-17) suggested the presence of an exomethylene moiety, and the molecular formula together with the spectral data suggested that the compound was a $C_{20}$-diterpenoid alkaloid. The $^{13}C$-nmr spectrum of 1 was similar to that of 15-veratroylpseudokobusine (3),[1] with the exception of presence of a new quartet at 42.8 ppm and a singlet at 203.1 ppm, and the absence of a singlet at ~98 ppm. These data suggested that yesoline was veratroyl ester of *N*-methyl-*N*,6-seco-6-dehydropseudokobusine (6). The structure of yesoline (1) was finally confirmed by the correlation with pseudokobusine (4), already isolated from the same plant,[1] as follows.

Treatment of pseudokobusine (4) with methyl iodide in methanol gave a methiodide

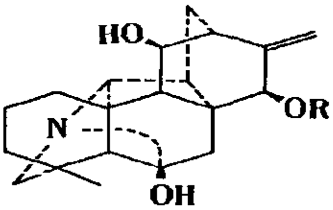


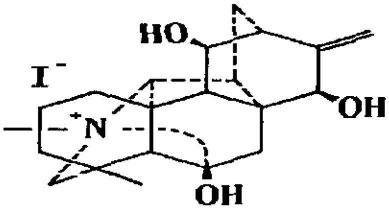


1: R=veratroyl

6: R=H

2





3: R=veratroyl

4: R=H

5

5, which was stirred with silver oxide in 50% aqueous methanol[3] to give an *N*-methyl ketone 6. On the other hand, alkaline hydrolysis of 1 afforded *N*-methyl-*N*,6-seco-6-dehydropseudokobusine (6). The *N*-methyl ketone 6 derived from pseudokobusine and the product drived by the hydrolysis of yesoline showed identical ir and nmr spectra, and the tlc behaviors.

## EXPERIMENTAL

All melting points are uncorrected. Ir spectra in KBr disks were taken with a JASCO IRA-2 spectrometer, and uv spectrum was measured in ethanol solution with a Shimazu D-300 spectrometer. Nmr spectra were measured in $CDCl_3$ solution with JOEL FX-100 and JOEL GX-270 spectrometers using TMS as an internal standard. Ms spectra were measured with a Shimazu LKB-9000B spectrometer, and HR-ms spectra were measured with JMS-D300 mass spectrometer. Elemental analyses were performed by the Analytical Center, Hokkaido University.

**Isolation procedure** -- In the previous paper,[1] we already reported the extraction and isolation of several alkaloids from the rhizoma of the title plant. The column chromatography of remaining crude alkaloid in the previous isolation procedure -1) and -2)[1] gave 33 mg and 15 mg of **1**, respectively. They also gave 39 mg and 96 mg of **2**, respectively.

**Yesoline (1)** -- amorphous, $(\alpha)_D^{23}=-10.6°$ (c=0.34, ethanol). HR-ms m/z: Calcd for $C_{30}H_{37}NO_6$ 507.2620, Found 507.2630. Ms: m/z 507 ($M^+$), 326 ($M^+$-OVr), 165 (veratroyl cation). Ir $\nu$ $cm^{-1}$: 3400, 1700, 1600, 1270. Uv $\lambda$ max nm (log $\varepsilon$): 262 (3.84), 291 (3.61). $^1$H-Nmr ($\delta$): 1.45 (3H, s), 2.45 (3H, s), 3.92 (3H, s), 3.93 (3H, s), 4.16 (1H, d, J=5.0 Hz), 5.23 (1H, s), 5.41 (1H, s), 5.66 (1H, s), 6.86 (1H, d, J=8.6 Hz), 7.52 (1H, d, J=2.0 Hz), 7.59 (1H, dd, J=2.0, 8.6 Hz). $^{13}$C-Nmr (ppm): 203.1 (s, C-6), 165.8 (s, C=O), 153.2 (s, C-4'), 148.7 (s, C-3'), 144.5 (s, C-16), 123.4 (d, C-6'), 122.1 (s, C-1'), 117.1 (t, C-17), 112.1 (d, C-2'), 110.2 (d, C-5'), 78.1 (d), 70.9 (d, C-15), 67.6 (d, C-11), 61.0 (t, C-19), 60.5 (d), 56.7 (d), 55.9 (q, $OCH_3$x2), 46.1 (t), 45.2 (s), 43.3 (s), 42.8 (q, *N*-$CH_3$), 42.7 (d), 41.3 (d), 40.3 (t), 38.1 (s, C-4), 31.8 (t), 31.4 (t), 30.7 (q, C-18), 18.9 (t).

**14-Dehydrodelcosine (2)** -- Mp 219-221℃ (lit.[2] 212.5-213.5℃). HR-ms m/z: Calcd for $C_{24}H_{37}NO_7$ 451.2570, Found 451.2562. Ms: m/z 451 ($M^+$), 436 ($M^+$-15, base peak), 420 ($M^+$-$OCH_3$). Ir $\nu$ $cm^{-1}$: 3450, 1750. $^1$H-Nmr ($\delta$): 1.12 (3H, t, J=7.3 Hz), 3.33 (3H, s), 3.34 (6H, s), 4.04 (1H, s).

**Pseudokobusine Methiodide (5)** -- Pseudokobusine (**4**, 100 mg) and methyl iodide (1 ml) in methanol (6 ml) were heated under reflux for 3 h. After cooling, the reaction mixture was evaporated and the residue was recrystallized from methanol to afford methiodide (**5**, 143 mg) in a quantitative yield. Mp 287℃ (decomp; lit.[4] 287℃). *Anal*: Calcd for $C_{21}H_{30}NO_3I$: C, 53.51; H, 6.41; N, 2.97; I, 26.92. Found C, 53.67; H, 6.47; N, 2.95; I, 26.81.

***N*-Methyl-*N*,6-seco-6-dehydropseudokobusine (6)** -- A mixture of methiodide (**5**, 70 mg), silver oxide (200 mg), and 50% aqueous methanol was stirred for 20 h at room temperature. Filtration of the mixture to remove silver salts and purification of the filtrate by column chromatography on silica gel afforded amorphous *N*-methyl-*N*,6-seco-6-dehydropseudokobusine (**6**, 48 mg) in a quantitative yield. HR-ms m/z: Calcd for $C_{21}H_{29}NO_3$ 343.2147, Found 343.2152. Ms: m/z 343 ($M^+$). Ir $\nu$ $cm^{-1}$: 3400, 1720, 910. $^1$H-Nmr ($\delta$): 1.45 (3H, s), 2.29 (3H, s), 3.84 (1H, s), 4.10 (1H, d, J=4.6 Hz, changed into s after addition of $D_2O$), 5.10 (1H, s), 5.24 (1H, s).

**Hydrolysis of yesoline (1)** -- Yesoline (1, 7 mg) in a 5% KOH-methanol was stirred for 4 h at room temperature. Usual work-up afforded *N*-methyl-*N*, 6-seco-6-dehydropseudokobusine (6, 3 mg) in 64% yield.

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Received, 25th January, 1988