4-(Z-Pro-amino)oxazolidone-2——Z–Pro–Ser–N_3 was prepared in a cold room (4°) as follows. Z–Pro–Ser–$NHNH_2$ (0.35 g) was dissolved in 1 N HCl (3 ml) and cooled with ice-salt. $NaNO_2$ (0.1 g) in H_2O (0.5 ml) was added to the cold solution with stirring. After 5 min, the azide was extracted with $CHCl_3$ (15 ml), and the extract was washed with 5% $NaHCO_3$ and water, then dried over Na_2SO_4. The solution was kept at room temperature (25°) overnight and then concentrated. Petroleum ether was added to the residue to form a white precipitate, which was collected by filtration and recrystallized from AcOEt; yield 0.09 g (27%), mp 193—195°, $[\alpha]_D^{25}$ −47.4° (c=0.8, DMF). *Anal.* Calcd for $C_{16}H_{19}N_3O_5$: C, 57.6; H, 5.74; N, 12.6. Found: C, 57.6; H, 5.47; N, 12.5.

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Studies on the Constituents of Asclepiadaceae Plants. XLVIII.[1] 5α,6α-Epoxycaudatin, a New Polyoxypregnane Derivative from *Cynanchum caudatum* Max.

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A new polyoxypregnane derivative, 5α,6α-epoxycaudatin, was isolated from *Cynanchum caudatum* Max. and its structure was elucidated on the bases of physical data and chemical reaction. This compound is a probable intermediate in the biosynthesis of 5,6-glycolic compounds. Kidjoranin was also isolated from this plant for the first time.

Keywords——5α,6α-epoxycaudatin; polyoxypregnane; Asclepiadaceae; *Cynanchum caudatum* Max.; kidjoranin; epoxidation; 5,6-glycolpregnane; 5α,6α-epoxycynanchogenin

The structures of several polyoxypregnane derivatives from *Cynanchum caudatum* Max. (Asclepiadaceae) were reported in our previous paper.[3] From the same crude aglycone mixture, cynanchogenin (II),[4] caudatin (III),[5] penupogenin (VI),[6,7] 20-O-cinnamoylsarcostin (VII),[3] ikemagenol derivatives (VIII) and (IX),[3] compound I and compound V were isolated. The spectral data and *Rf* values on thin-layer chromatography (TLC) of compounds (I) and (V) were similar to those of penupogenin and caudatin, respectively. Compound (I), mp 146—149°, was found to be identical with kidjoranin[6] by comparison of the spectral data and mixed mp (145—150°) with those of an authetic sample.

The object of the present paper is to report the structure elucidation of a new compound, V. V showed the following properties: mp 215—219.5° $[\alpha]_D$ −30° (c=0.23, MeOH), molecular

1) Part XLVII: H. Bando, T. Amiya, and H. Mitsuhashi, *Chem. Pharm. Bull.*, **27**, 3106 (1979).
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3) H. Bando and H. Mitsuhashi, *Chem. Pharm. Bull.*, **26**, 2128 (1978).
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formula $C_{28}H_{42}O_8$ from the mass spectrum (M^+ at *m/e* 506). The ultraviolet (UV) spectrum of V showed an absorption maximum at 222 nm (log ε, 4.21), indicating the presence of a conjugated ester group. The infrared (IR) spectrum of V showed absorptions for hydroxyl groups at 3550, 3450, and 3300 cm^{-1}, a carbonyl group at 1710 cm^{-1}, and a conjugated ester group at 1700, 1640, and 1170 cm^{-1}. The ^1H-nuclear magnetic resonance (^1H-NMR) spectrum showed signals of two tertiary methyl groups at δ 1.10 and 1.43, two overlapping secondary methyl groups at δ 1.06 (6H, d, J=6 Hz), one vinyl methyl group with long range coupling at δ 2.18 (d, J=1.5 Hz), one acetyl group at δ 2.20, three oxygenated methines at δ 3,42 (broad s), 3.72 (m), and 4.46 (t, J=5 Hz), and one vinyl proton at δ 5.53 (broad s). The ^{13}C-nuclear magnetic resonance (^{13}C-NMR) data for V are listed in the table together with those for caudatin (III), cynanchogenin (II),[8] and the epoxide (IV) derived from II. An epoxide structure is consistent with the ^{13}C-NMR spectrum of V because two oxygenated carbon atoms, C-5 and C-6, were shifted to higher field.[9] V was identified as 5α,6α-epoxycaudatin by comparison of the spectral data and by mixed mp determination with a compound obtained from III by epoxidation.[10] This compound (V) is the first epoxide derivative isolated from *Cynanchum caudatum*. Since several 5,6-glycol compounds such as glycocynanchogenin,[11] 12-O-cinnamoyl-20-O-acetylglycosarcostin,[12] glycocaudatin,[10] and glycopenupogenin[13] have been isolated from this plant, it is likely that V is related to a biogenetic intermediate in the transformation of the 5-ene system to 5,6-glycol in polyoxypregnanes.

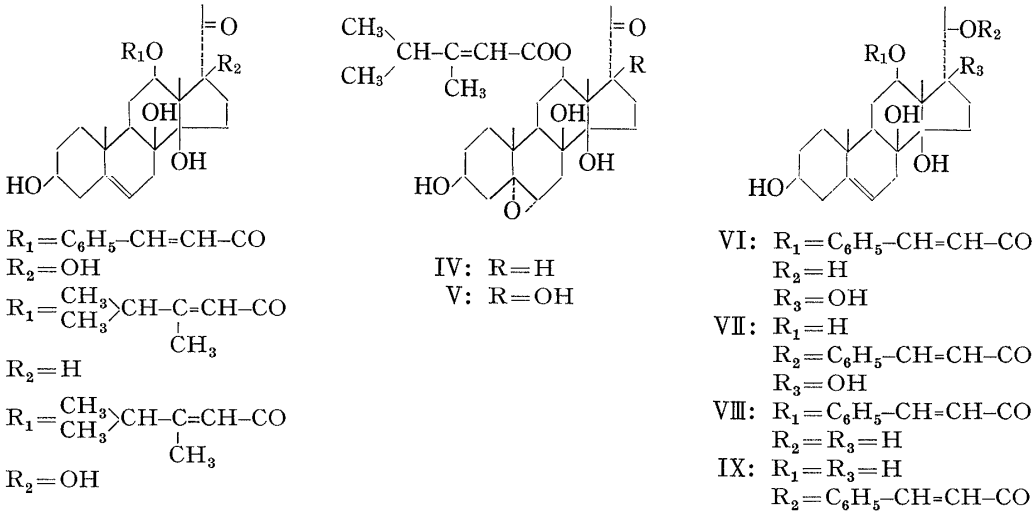

Chart 1

Experimental

Melting points were determined using a Yanaco micro melting point apparatus and are uncorrected. The UV spectrum was recorded on a Shimadzu UV-300 double beam spectrometer. IR spectra were recorded on a Hitachi 215 spectrometer. Mass spectra (MS) were recorded on a Shimadzu LKB-9000B mass spectrometer. ^1H-NMR and ^{13}C-NMR spectra were recorded on a JEOL FX-100 spectrometer with tetramethylsilane as an internal standard. Optical rotations were taken with a JASCO DIP-4 digital polarimeter. TLC was carried out using silica gel (HF_{254}, type 60, Merck).

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Isolation Procedure——From the crude aglycone mixture (250 g) reported previously[3,10] a mixture (1.4 g) containing cynanchogenin, caudatin, and penupogenin was separated by silica gel column chromatography. Preparative TLC of the mixture, developing with a solution of ethyl acetate–hexane (3: 2), gave fraction I and fraction II, of which the latter containing epoxycaudatin (V). Crystallization of fraction I from ethyl acetate–hexane yielded kidjoranin, 52 mg, which was identical with an authentic sample (mp and mixed mp).

5α,6α-Epoxycaudatin (V)——Fraction II was further purified by preparative TLC, developing with a solution of acetone–hexane (1: 2) to yield V (30 mg) on crystallization from ethyl acetate–hexane. Recrystallization from benzene–hexane gave needles, mp 215—219.5°, undepressed by admixture with caudatin epoxide. $[\alpha]_D$ −30° (c=0.23, MeOH). IR ν_{max}^{Nujol} cm^{-1}: 3550, 3450, 3300, 1710, 1700, 1640, 1170. ^{1}H-NMR $(\delta)_{CDCl_3}$: 1.06 (6H, d, J=6 Hz), 1.10 (3H, s), 1.43 (3H, s), 2.18 (3H, d, J=1.5 Hz), 2.20 (3H, s), 3.42 (1H, broad s), 3.72 (1H, m), 4.46 (1H, t, J=5 Hz), 5.53 (1H, broad s). ^{13}C-NMR: Chemical shifts and splitting patterns are summarized in Table I. MS m/e: 506 (M^+), 488 (M^+-H_2O), 470 (M^+-2H_2O), 463 (M^+-COCH_3), 445 ($M^+-COCH_3-H_2O$), 378 (M^+—ikemaoic acid), 11 (base peak, ikemaoyl cation).

Table I. ^{13}C-Chemical Shifts and Splitting Patterns

No.	II	III	IV	V
1	38.5(t)	38.7(t)	38.3(t)	38.1(t)
2	30.8(t)	30.7(t)	30.2(t)	30.2(t)
3	71.5(d)	71.5(d)	69.0(d)	69.0(d)
4	41.9(t)	41.9(t)	41.2(t)	41.1(t)
5	140.8(s)	140.5(s)	64.3(s)	64.2(s)
6	117.5(d)	117.6(d)	65.2(d)	64.9(d)
7	34.6(t)	34.2(t)	32.5(t)	32.7(t)
8	74.9(s)	74.3(s)	75.6(s)	75.2(s)
9	44.1(d)	43.7(d)	44.7(d)	44.4(d)
10	37.1(s)	36.9(s)	35.8(s)	35.9(s)
11	24.4(t)	24.3(t)	24.8(t)	24.3(t)
12	71.2(d)	71.8(d)	71.0(d)	70.8(d)
13	55.1(s)	57.8(s)	55.0(s)	57.3(s)
14	86.9(s)	88.1(s)	86.3(s)	87.7(s)
15	33.4(t)	33.1(t)	31.0(t)	30.6(t)
16	20.9(t)	31.9(t)	21.3(t)	31.6(t)
17	59.9(d)	91.5(s)	59.9(d)	91.5(d)
18	15.1(q)	9.5(q)	15.2(q)	9.8(q)
19	18.6(q)	18.6(q)	17.4(q)	17.3(q)
20	209.7(s)	208.9(s)	209.0(s)	208.5(s)
21	31.9(q)	27.1(q)	32.0(q)	27.0(q)
1′	166.0(s)	166.7(s)	166.2(s)	165.9(s)
2′	114.1(d)	113.0(d)	113.0(d)	112.6(d)
3′	165.1(s)	165.9(s)	165.8(s)	165.3(s)
4′	38.0(d)	38.2(d)	38.1(d)	38.0(d)
5′	20.9(q)	20.9(q)*	20.8(q)	20.8(q)*
6′	20.9(q)	21.0(q)*	20.8(q)	20.9(q)*
7′	16.4(q)	16.5(q)	16.5(q)	16.5(q)

a) δ (ppm) downfield from tetramethylsilane in $CDCl_3$.
b) Assignments with an asterisk may be interchanged in each column.

Epoxidation of Caudatin (III) and Cynanchogenin (II)——a) Eupoxidation of III was successfully achieved by the method reported in the previous paper.[10]

b) 5α,6α-Epoxycynanchogenin (IV): The procedure used for II (205 mg) gave epoxycynanchogenin (IV) (201 mg) which was recrystallized from ethyl acetate–hexane to give needles, mp 184—186.5°, *Anal.* Calcd for $C_{28}H_{42}O_7$: C, 68.54; H, 8.63. Found: C, 68.11; H, 8.71. IR ν_{max}^{Nujol} cm^{-1}: 3540, 3430, 3400, 1705, 1695, 1650. ^{1}H-NMR $(\delta)_{CDCl_3}$: 1.06 (6H, d, J=7 Hz), 1.12 (3H, s), 1.47 (3H, s), 2.14 (6H, s), 3.40 (1H, broad s), 3.70 (1H, m), 4.50 (1H, d.d, J=4, 10 Hz), 5.50 (1H, broad s). ^{13}C-NMR: Chemical shifts and splitting patterns are summarized in Table I.

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