(δ 147.9 and 121.3) was observed, and these signals were easily assigned to C-22 and C-23, respectively. The lactone carbonyl signal (δ 159.8) was not very different from that of I. There was a marked change compared with I, which gave another pair of double bond carbon signals. In the spectrum of II, no other olefinic carbon signals were seen, but new signals appeared at δ 56.5 (s) and 84.6 (d). The former was a typical epoxide carbon as judged by its chemical shift,[4] and the latter signal was consistent with C-21, a two-oxygen-substituted carbon, in view of its chemical shift and multiplicity. The stereochemistry at C-20 is under investigation.

As far as we know, this compound is the first example of a bufogenin which has two epoxide rings in the molecule at unusual positions. Testing of II for biological activity is in progress.

Experimental

Isolation of II——Commercial toad cake (Bufonis Venenum, J.P.IX) from Tokyo Market (100 g) was exhaustively extracted with $CHCl_3$ in a Soxhlet extractor to obtain an extract (*ca.* 25 g), which was chromatographed on Si gel with a mixture of C_6H_6–Me_2CO (7: 1). Just before the elution of resibufogenin (I), a new compound (II) (100 mg) was obtained as colorless needles, mp 197—202°. Upon TLC on a precoated Si gel plate (Merck 5554), developed with C_6H_6–Me_2CO (5: 2) followed by spraying H_2SO_4 and heating, II appeared as a reddish-brown spot at *Rf* 0.52,[1] while I was a dark-green spot at *Rf* 0.41. Compound II gave $[\alpha]_D^{22}$ +50° (EtOH, c=0.02), *Anal.* Calcd for $C_{24}H_{32}O_5$: C, 71.97; H, 8.05. Found: C, 71.82; H, 8.39. IR ν_{max}^{KBr} cm^{-1}: 3400, 2930, 1740, 1120, 1080. UV λ_{max}^{EtOH} cm^{-1} 225 nm (inflection). MS *m/z*: 400 (M^+), 382 (M^+-H_2O), 356 (M^+-CO_2). PMR and ^{13}C-NMR: See text.

^{13}C-NMR Measurement——The spectrum of each compound (50 mg) in $CDCl_3$ (1 ml) (10 mm tube) was recorded at 25° with TMS as an internal standard. The spectrometer (JEOL PFT-100) was operated at 25.15 MHz, with a 16 μsec (45°) pulse every 3.0 sec (1000 scans) and 8W of wideband r.f. for ^{1}H decoupling. It was connected to an EC-6 computer (8192 data points for 5 kHz). Where appropriate, assignments were confirmed by off-resonance decoupling, selective decoupling or a PRFT experiment.

References and Notes

1) M. Komatsu, Y. Kamano, and M. Suzuki, *Japan Analyst*, **14**, 1049 (1965).
2) Y. Kamano, H. Yamamoto, Y. Tanaka, and M. Komatsu, *Tetrahedron Lett.*, **1968**, 5673.
3) K. Tori, H. Ishii, Z.W. Wolkowski, C. Chachaty, M. Sangaré, F. Piriou, and G. Lukacs, *Tetrahedron Lett.*, **1973**, 1077.
4) D.R. Paulson, F.Y.N. Tang, G.F. Moran, A.S. Murray, B.P. Pelka, and E.M. Vesquez, *J. Org. Chem.* **40**, 184 (1975).

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New Methods and Reagents in Organic Synthesis. 9.[1] C-Acylation of Nitromethane with Aromatic Carboxylic Acids using Diethyl Phosphorocyanidate (DEPC)

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Aromatic α-nitroketones can be conveniently prepared from aromatic carboxylic acids and nitromethane by the action of diethyl phosphorocyanidate (DEPC) in the presence of triethylamine.

Keywords——C-acylation; α-nitroketone; organophosphorus reagent; condensation; aromatic carboxylic acids

Although a few procedures[2,3,4] for the preparation of α-nitroketones by the C-acylation of nitromethane have been reported, they generally require prior preparation and isolation of activated derivatives of carboxylic acids, such as acyl cyanides,[2] N-acyl imidazoles,[3] or phenyl esters.[4] Furthermore, they have such drawbacks as the use of potentially pyrophoric and explosive alkali nitronates[3,4] and relatively severe reaction conditions (strong bases,[3,4] prolonged reflux[3]).

In our previous paper[5] of this series, we described an efficient procedure for the direct C-acylation of active methylene compounds with carboxylic acids using a combination of diethyl phosphorocyanidate (DEPC, $(C_2H_5O)_2P(O)CN$)[6] and triethylamine. Nitromethane has also been C-acylated with benzoic acid under similar reaction conditions to give α-nitroacetophenone. Further investigations along this line have widened the scope of the procedure for the C-acylation of nitromethane and supported its generality. Thus, aromatic carboxylic acids (**1**) can be easily converted to α-nitroketones (**2**) by treatment with nitromethane and DEPC in the presence of triethylamine in dimethylformamide solution.

$$\underset{\mathbf{1}}{ArCO_2H} + CH_3NO_2 \xrightarrow[(C_2H_5)_3N]{(C_2H_5O)_2P(O)CN} \underset{\mathbf{2}}{ArCOCH_2NO_2}$$

Table I. Preparation of Aromatic α-Nitroketones (**2**)

α-Nitroketone	R	Yield[%]
2a	4-CH_3–C_6H_4	76
2b	4-CH_3O–C_6H_4	81
2c	4-CH_3CONH–C_6H_4	79
2d	2-Cl–C_6H_4	28[a]
2e	3-Cl–C_6H_4	40[b]
2f	3,4-(OCH_2O)-C_6H_3	73
2g	α-Naphthyl	62

a) Imidazole (1.2 equiv) was used together with triethylamine.
b) Imidazole (2.0 equiv) was used together with triethylamine.

Although the yields have not been optimized yet, the usefulness of the procedure is well exhibited in Table I. The actual reaction species for the C-acylation are presumably acyl cyanides and/or acyl phosphates,[6,7] but their isolation is unnecessary. The reaction procedure is quite simple and the C-acylation proceeds under mild conditions without formation of hazardous alkali nitronates. Although our experiments have been confined to the preparation of aromatic α-nitroketones (**2**), which shoud be good precursors for the synthesis of pharmaceuticals bearing β-aminoalcohol functions, aliphatic α-nitroketones could probably also be prepared by this procedure.

Experimental

Mp's are not corrected.

Direct C-Acylation of Nitromethane; General Procedure——To a stirred mixture of a carboxylic acid (**1**, 2.4 mmol) and nitromethane (0.122 g, 2 mmol) in dimethylformamide (4 ml) was added DEPC (0.424 g, 2.6 mmol) in dimethylformamide (2 ml) at 0°, followed by the addition of triethylamine (0.648 g, 6.4 mmol) in dimethylformamide (2 ml). The mixture was stirred at 0° for 2 hr, and then at room temperature for 20 hr. Benzene-ethyl acetate (1: 1, 100 ml) was added and the mixture was successively washed with 10% aqueous citric acid, water, and saturated aqueous sodium chloride. Drying over sodium sulfate followed by evaporation gave the crude α-nitroketone (**2**) which was purified by silica gel column chromatography

Table II. Physical Properties and Elemental Analysis of α-Nitroketones (2)

α-Nitro-ketone	mp (°C)	Recryst. solvent	IR ν_{max}^{Nujol} cm^{-1} CO, NO_2(as), NO_2(s)	NMR ($CDCl_3$) δ[ppm] α-CH_2
2a[a]	146.5—149	$CHCl_3$/*n*-C_6H_{14}	1690, 1550, 1330	5.88
2b[b]	156—161	$CHCl_3$	1690, 1550, 1330	6.30[c]
2c[d]	221.5—224[e]	$HCON(CH_3)_2/H_2O$	1690, 1560, 1325	6.44[f]
2d	54.5—55.5[g]	C_2H_5OH/H_2O	1700, 1550, 1315	5.75
2e	96—98[h]	C_2H_5OH	1700, 1570, 1320	5.90
2f[i]	169—170[e]	$CH_3CO_2C_2H_5$	1675, 1550, 1330	6.20[c]
2g[j]	124.5—127.5	$CHCl_3$/*n*-C_6H_{14}	1700, 1560, 1312	5.94

a) *Anal.* Calcd for $C_9H_9NO_3$: C, 60.33; H, 5.07; N, 7.82. Found: C, 60.23; H 4.83; N 7.98.
b) *Anal.* Calcd for $C_9H_9NO_4$: C, 55.38; H, 4.65; N, 7.18. Found: C, 55.28; H, 4.61; N, 7.02.
c) Dimethylsulfoxide-d_6 was used as a solvent.
d) *Anal.* Calcd for $C_{10}H_{10}N_2O_4$: C, 54.05; H, 4.54; N, 12.61. Found: C, 54.29; H, 4.32; N, 12.50.
e) Accompanied by decomposition.
f) A mixture of dimethylsulfoxide-d_6 and deuteriochloroform was used as a solvent.
g) Reported[4] mp 53.5—54.5°.
h) Reported[4] mp 96—97°.
i) *Anal.* Calcd for $C_9H_7NO_5$: C, 51.68; H, 3.37; N, 6.70. Found: C, 51.97; H, 3.23; N, 6.98.
j) *Anal.* Calcd for $C_{12}H_9NO_3$: C, 66.97; H, 4.22; N, 6.51. Found : C, 67.01; H, 4.13; N, 6.26.

with benzene–ethyl acetate (20—50: 1) and by recrystallization. The physical properties and the results of elemental analysis are summarized in Table II.

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References and Notes

1) Part 8: T. Aoyama and T. Shioiri, *Tetrahedron Lett.*, **21**, 4461 (1980).
2) G.B. Bachman and T. Hokama, *J. Am. Chem. Soc.*, **81**, 4882 (1959).
3) D.C. Baker and S.R. Putt, *Synthesis*, **1978**, 478.
4) G.F. Field and W.J. Zally, *Synthesis*, **1979**, 295.
5) T. Shioiri and Y. Hamada, *J. Org. Chem.*, **43**, 3631 (1978).
6) For a review, see: T. Shioiri, *Yuki Gosei Kagaku Kyokai Shi*, **37**, 856 (1979).
7) T. Shioiri, Y. Yokoyama, Y. Kasai, and S. Yamada, *Tetrahedron*, **32**, 2211, 2854 (1976).

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Triterpenoids of the Bark of *Pieris japonica* D. Don

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Triterpenoids in the bark of *Pieris japonica* D. Don were investigated. Oleanolic acid acetate, ursolic acid acetate, ursolic acid, β-sitosterol, lupeol and compound A (VI), mp 262—263°, $C_{32}H_{50}O_5$, were obtained. The physical properties of VI were elucidated by infrared absorption, nuclear magnetic resonance (NMR), ^{13}C-NMR and mass spectral studies. The structure of VI is probably 3β-acetoxy-16α-hydroxy-ursan-28,19-olide.

Keywords——*Pieri japonica*; bark; triterpenoid; ursan-type γ-lactone; 3β-acetoxy-16α-hydroxy-ursan-28,19-olide