LETTERS TO THE EDITOR

REACTIONS OF CYCLIC ANHYDRIDES. SYNTHESES OF 3-OXO-1, 4-BENZOTHIAZINES AND 2-OXO-QUINOXALINES. A NOVEL APPROACH *VIA* MALEANILIC ACIDS

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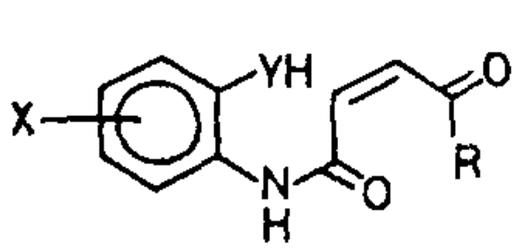
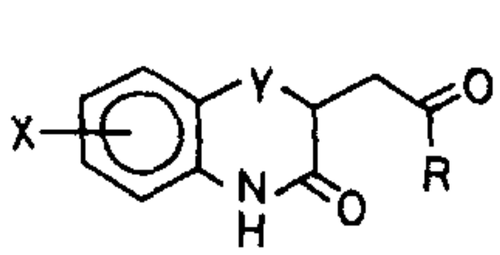
WE have earlier reported the facile formation of 2-oxo-quinolines[1] (IIA, IIB) and 3-oxo-1,4-benzoxazines[2] (IIC) through base-induced intramolecular cyclization of suitably ortho-substituted maleanilic acid derivatives (IA, IB and IC respectively). As a logical extension, we have examined the reaction of *o*-aminothiophenol (*o*-ATP) with maleic anhydride (MA). Addition of *o*-ATP to MA occurred



I



II

	X	Y	R
IA,	5-NO_2	CH_2	OCH_3
IB,	5-NO_2	CH_2	OC_2H_5
IC,	H	O	OCH_3
ID,	H	S	OH
IG,	4-Cl	NH	OCH_3

	X	Y	R
IIA,	7-NO_2	CH_2	N⟨ ⟩
IIB,	7-NO_2	CH_2	N⟨ O
IIC,	H	O	OCH_3
IID,	H	S	OH
IIE,	H	S	OCH_3
IIF,	H	S	OC_2H_5
IIG,	6-Cl	NH	OCH_3

in an exothermic reaction to directly yield the cyclized acid IID. The corresponding *o*-mercapto maleanilic acid (ID) formed from initial nucleophilic anhydride ring opening with amino nitrogen appears to be the most likely precursor; however, it could not be isolated from the reaction mixture. A typical reaction was run as follows: To a solution of MA (4·9 g; 0·05 m) in either (20 ml), a solution of *o*-ATP (6·25 g 0.05 m) in ether (20 ml) was added at room temperature (27 ± 2°C) swirling the mixture during addition. The warm reaction mixture on cooling furnished a colorless solid in quantitative yield; m.p. 201–2°C (EtOH) in agreement with reported[3,4] values. IID was converted to the known methyl ester[4,5] (IIE) and the ethyl ester (IIF)[4,6]. PMR of IIE ($CDCl_3$, δ): 2·59 (dd, J = 16, 8Hz, H_A), 3·08 (dd, J = 16, 7 Hz, H_B), 3·73 (s, 3H, OCH_3), 4·01 (dd, J = 8, 7 Hz, Hx), 6·82 – 7·32 (m, 4H, aromatic), 9·4 (bs, 1H, NH, exch. D_2O); IIF : 1·28 (t, 3H, CH_2CH_3); 2·57 (dd, J = 16, 8 Hz, H_A), 3·11 (dd, J = 16. 7Hz, H_B), 4·01 (dd, J = 8, 7Hz, H_X), 4·32 (q, 2H, CH_2CH_3), 6·85 – 7·32 (m, 4H, aromatic), 9·6 (bs, 1H, NH, exch. D_2O). Satisfactory IR/PMR and elemental analyses were obtained for all new compounds, consistent with the assigned structures. Use of nitrogen atmosphere neatly eliminates oxidative coupling of *o*-ATP to the disulphide, a side reaction encountered in earlier work.

We also obtained 2-oxo-quinoxaline IIG by similar intramolecular Michael-type addition of methyl 2-amino-4-chloromaleanilate (IG) prepared *in situ* from the 2-nitro-ester. To a solution of 2-nitro-4-chloromaleanilic acid (135 g) in methanol (180 ml), conc. sulphuric acid (2·00 ml) was added and the mixture kept at 27±2°C for 5 hr. Aqueous work-up furnished the methylester in 90% yield, m.p. 98–100°; IR (nujol, cm^{-1}) : 1600, 1630, 1675, 1725, 3325, PMR ($CDCl_3$, δ ppm) : 3·8 (s, 3H, OCH_3), 6·26 (d, J = 12 Hz, 1H, vinyl H), 6·5 (d, J = 12 Hz, 1H, vinyl H), 7·6 (dd, J = 9, 3 Hz, 1H), 8·18 (d, J = 3Hz, 1H), 8·72 (d, J = 9Hz, 1H), 10·57 (bs, 1H, NH, exch. D_2O). The foregoing nitro-ester (1 g) in ethanol (200 ml) was hydrogenated in presence of W-2 Raney nickel (about 0·5 g) at a pressure of 40 psi. When hydrogen uptake was complete (1·5 h), filtration of catalyst and concentration of the reaction mixture over a water bath and aqueous work-up afforded II G (82% yield); recrystallized from aqueous ethanol, m.p. 154 – 55°. PMR : 2·68 (dd, J = 17, 9Hz, H_A) 3·10 (dd, J = 17, 3 Hz, H_B), 3·72 (s, 3H, OCH_3), 4·26 (dd, J = 9, 3Hz, H_X), 4·8 (bs, 1H, NH–Ar, exch. D_2O), 6·65 (m, 3H, aromatic), 9·41 (bs, 1H, NHCO, exch. D_2O).
Calcd. for $C_{11}H_{11}N_2O_3Cl$: 51·98, H, 4·33, N, 10·98.
Found: C, 52·24, H, 4·50; N, 11·06.

The present approach to benzothiazines[7] and quinoxalines[8] does not appear to have been exploited so far.

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STEROIDAL CONSTITUENTS OF DIFFERENT PARTS OF *ASPARAGUS CURRILLUS* BUCH-HAM

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ASPARAGUS plants (Liliaceae) have been reported[1] for their medicinal uses. However, no chemical work appears to have been done on the constituents of *Asparagus curillus* Buch-Ham which grows wild in Garhwal Himalayas.[2]

The comparative study of the sapogenin contents of different parts of the plant is summarised in table 1. Here the method of isolation from the fruits is given. Similar methods were used for the isolation from the leaves and roots.

TABLE 1

Steroidal constituents of Asparagus curillus Buch-Ham

Part of the plant	Dry weight (g)	Saponin mixture (g)	Sterol/ Sapogenin	(g)	Percentage (%)
Roots	500	15	Sitosterol		
			Stigmasterol	2·5	0·5
			Sarsasapogenin	12·5	1
Leaves	800	4·5	Sitosterol	0·5	0.6
			Stigmasterol		
			Sarsasapogenin	0·8	0·10
Fruits	500	20	Sitosterol	3	0·6
			Stigmasterol		
			Sarsasapogenin	15	3

Well dried, coarsely powdered fruits (500 g), collected from Pauri (U.P.), India, were defatted and exhaustively extracted with methanol (1 lit) until the extractives became colourless. The dark brown syrupy mass, obtained after recovery of the solvent, was purified to isolate saponins. The resultant mass (20 g) was hydrolysed with 10% aqueous H_2SO_4/ MeOH (1:1, 100 ml) on a boiling water bath for 4 hr, cooled and filtered. The residue was chromatographed over Si-gel (C_6H_6–$CHCl_3$; 98:2) to get TLC homogenous component A (3 g) and component B (15 g).

Component A ($C_{29}H_{48-50}O$): It was positive to Liebermann-Burchard test, indistinguishable from an authentic sample of β-sitosterol[3]. Crystallised as colourless needles (MeOH), m.p. 145–147°C, $[\alpha]_D^{20}$ −39° ($CHCl_3$) [lit.[3] : β-sitosterol, m.p. 134–136°C, $[\alpha]_D^{20}$ −35° ($CHCl_3$); lit.[4]: stigmasterol, m.p. 166–168°C, $[\alpha]_D$ −46°]. IR (γ_{max}^{KBr} cm^{-1}): 3400 (OH), 2940, 2870, 1480, 1390, 990, 920, 885 [(Δ_T and $\Delta^{22\,23}$ MS/ (m/e): 414 (M^+ for sitosterol) 412 (M^+ for stigmasterol), 399, 396, 303, 273, 255, 213. Acetate (C_{31} H_{50-52} O_2): Prepared as usual, m.p. 126-28° C, $[\alpha]_D^{20}$.37°.

All the above data suggest it to be a mixture of β-sitosterol and stigmasterol; therefore, component A (100 mg) was brominated as usual and the bromo-derivatives were separated by fractional crystallisation to get stigmasterol acetate tetrabromide m.p. 210–212°C, $[\alpha]_D^{20}$ −40° ($CHCl_3$). Debromination of β-sitosterol acetate dibromide afforded β-sitosterol acetate m.p. 129–31°C, $[\alpha]_D^{20}$ −40° ($CHCl_3$).

Component B (C_{27} H_{44} O_3): Colour less needles (MeOH, m.p. 193.196° C, $[\alpha]_D^{20}$.74.5° ($CHCl_3$) [lit.[3] : m.p. 194–197°C, $[\alpha]^{20}_D$ – 74·0° ($CHCl_3$)]. IR (γ_{max}^{KBr} cm^{-1}): 3400 (OH), 982, 915, 892, 850 (intensity 915 > 892, 25 S spiroketal). MS (m/e): 416 (M^+), 357, 347, 344, 302, 287, 273, 139 (base peak). Acetate ($C_{29}H_{46}O_4$): Prepared as usual, m.p. 140–142°C, $[\alpha]_D^{20}$– 68° ($CHCl_3$) [lit.[3] : m.p. 140–142°C, $[\alpha]^{20}_D$ – 68°]. IR (γ_{max}^{KBr} cm^{-1}): no OH, 1730, 1235 (OAc), 980, 915, 895, 850.

Component B was finally confirmed as sarsasapogenin by direct comparison (m.m.p., co. TLC and superimposable IR) with authentic sample[3].

All m.p.s. are uncorrected.

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