Short Communication

Stereoselective Synthesis of Dolicholide, a Plant Growth Promoting Steroid

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Dolicholide **1a** is a lactone belonging to the brassinolide family of phytosterols with plant growth promoting activity.¹⁾ We became interested in synthesizing **1a** soon after its isolation from the seeds of *Dolichos lablab* (Fujimame in Japanese) by Takahashi and his co-workers.¹⁾ We report here a synthesis of **1a** starting from a steroidal lactone **2a** previously prepared by us from stigmasterol.²⁾

Treatment of **2a** with 2,2-dimethoxypropane and *p*-toluenesulfonic acid in methylene chloride gave an acetonide **2b** (82% yield), $[\alpha]_D^{20} + 27.5^\circ$ ($c = 1.03$, CHCl_3). This was oxidized with pyridinium chlorochromate in methylene chloride in the presence of sodium acetate to give an unstable aldehyde **3** (85% yield). An organoaluminum reagent **4** was

prepared according to the method of Fung and Siddall.³⁾ Reaction between **3** and **4** in *n*-hexane-ether-tetrahydrofuran ($-10 \sim 22^\circ\text{C}$, 18 hr) proceeded in a highly stereoselective manner³⁾ to give an alcohol **5** (36% yield), mp $225 \sim 226^\circ\text{C}$, $[\alpha]_D^{20.5} + 35.9^\circ$ ($c = 0.518$, CHCl_3); ^{13}C -NMR (25 MHz, CDCl_3) δ 70.3, 71.2, 72.5, 73.1, 107.6, 124.7, 143.0, 176.6. This was oxidized with *m*-chloroperbenzoic acid in methylene chloride to give an epoxide **6** (97% yield), $[\alpha]_D^{22} + 24.7^\circ$ ($c = 1.78$, CHCl_3); ^1H -NMR (400 MHz, CDCl_3) 0.73 (3H, s), 0.88 (3H, s), 0.93 (3H, d, $J = 7$ Hz), 1.00 (3H, d, $J = 7$ Hz), 1.05 (3H, d, $J = 7$ Hz), 1.21 (3H, s), 1.31 (3H, s), 1.51 (3H, s), 2.81 (1H, d, $J = 7.8$ Hz), 3.30 (1H, dd, $J_1 = 10$, $J_2 = 7$ Hz), 3.58 (1H, d, $J = 7.8$ Hz), 4.10 (2H, m), 4.38 (2H, seemingly t). The cleavage of the epoxy ring of **6** with aluminum isopropoxide in toluene (reflux, 30 min) yielded **1b** (94% yield), $[\alpha]_D^{22} + 26.5^\circ$ ($c = 1.27$, CHCl_3); IR ν_{max} cm^{-1} : 3450 (m), 1730 (s), 1640 (w), 900 (m). Finally, the removal of the acetonide protective group with acetic acid-water (4:1; 50°C , 30 min) afforded dolicholide **1a** (47% yield), mp $235 \sim 237^\circ\text{C}$ (lit.¹⁾ $234 \sim 238^\circ\text{C}$), $[\alpha]_D^{22} + 56.3^\circ$ ($c = 0.405$, MeOH); IR ν_{max} cm^{-1} : 3400 (s), 1730~1695 (br. s), 1640 (w), 900 (m). Its ^1H -NMR spectrum measured at 400 MHz was completely identical to that of the natural product. The present synthesis firmly estab-

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lished the correctness of the proposed structure **1a** for dolicholide. In a similar manner to that described above, a synthesis of dolichosterone (a normal 6-keto steroid corresponding to **1a**) is in progress and will be published elsewhere together with a full account of the present work.

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