Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

3α,20-Bis(dimethylamino)-4,4,14-trimethyl-9,19-cyclo-5α-pregnan-16-ol

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Received 11 September 2006
Accepted 13 September 2006

The title compound, $C_{28}H_{50}N_2O$, also known as cyclovirobuxine A, was obtained from *N*-methylation of naturally occurring cyclovirobuxine D. It has a four-ring triterpenoid nucleus in a *trans–cis–trans* configuration. The six-membered rings have chair conformations, while the conformation of the five-membered ring is an envelope.

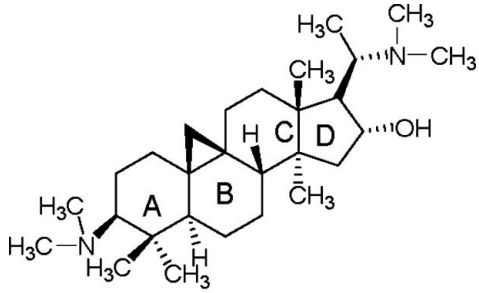
Key indicators

Single-crystal X-ray study
T = 294 K
Mean σ(C–C) = 0.009 Å
R factor = 0.054
wR factor = 0.095
Data-to-parameter ratio = 7.9

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

Comment

The Buxus plants are a rich source of triterpenoid alkaloids. Previous phytochemical studies on the Buxus species have resulted in the isolation of more than 200 such compounds (Rahman & Choudhary, 1998). In the traditional system of medicine, extracts of genus Buxus have been used for the treatment of various disorders (Cordell, 1981). The title compound, (I), also known as cyclovirobuxine A, possessing potential applications in the treatment of cardiovascular and cerebrovascular diseases (Chiu & Nie, 1992), was isolated and its structure elucidated for the first time by Khuong-Huu-Laine *et al.* (1966). We have semi-synthesized the title compound, (I), from naturally occurring cyclovirobuxine D.



(I)

In the molecule of (I) (Fig. 1), the bond lengths and angles are within normal ranges (Allen *et al.*, 1987). The structure of (I) contains the fused four-ring triterpenoid system: *A*, *B*, *C* and *D*. Similar to cyclovirobuxine D (Choudhary *et al.*, 2003), the triterpenoid nucleus has a *trans–cis–trans* configuration for ring junctions *A*/*B*, *B*/*C* and *C*/*D*.

Rings *A*, *B* and *C* are not planar, having total puckering amplitudes, Q_T, of 0.554 (3), 0.510 (4) and 0.625 (4) Å, respectively, and chair conformations [φ = −95.77 (10)°, θ = 3.17 (5)°; φ = 85.75 (7)°, θ = 42.72 (6)°; and φ = −89.92 (5)°, θ = 110.47 (5)°; Cremer & Pople, 1975]. The conformation of ring *D* is an envelope, with atom C11 at the flap position, 0.701 (5) Å from the mean plane through the other four atoms.

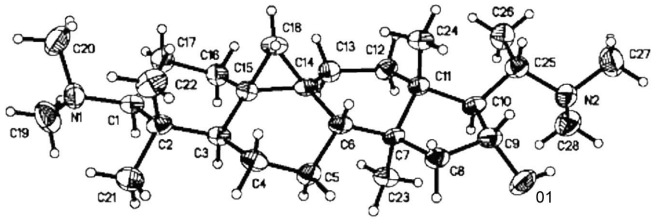


Figure 1
The molecular structure of (I), with the atom-numbering scheme. Displacement ellipsoids are drawn at the 50% probability level.

The dimethylamino substituents are attached to rings *A* and *D*; the torsion angles N1—C1—C17—C16 [−172.4 (5)°] and C19—N1—C1—C17 [92.9 (6)°] are indicative of a (+)-synclinal conformation. The sums of the bond angles around N1 (335.8°) and N2 (335.4°) indicate sp^3 character of the two N atoms.

Experimental

Wood extract containing cyclovirobuxine D, (1) (65.9%), cyclobuxine D (24.3%) and other Buxus alkaloids (9.84%) was purchased from Jiangsu, China. The crude alkaloid was then purified according to the literature method (Choudhary *et al.*, 2003) followed by recrystallization from acetone. The melting point of purified compound (1) is 493–494 K (acetone, decomp.), similar to that (494-497 K) reported in the literature (Brown & Kupchan, 1964). To a high-pressure autoclave (1000 ml) containing Pd/C (1 g, 10%) and C_2H_5OH (300 ml) were added aqueous formaldehyde (15 ml, 37%) and purified cyclovirbuxine D (10 g). The *N*-methylation reaction was performed by stirring with H_2 at 2 atmospheres pressure at 363 K. After 6 h, the mixture was filtered, the solvent was evaporated and the residue was recrystallized from acetone. The melting point is 514–515 K (decomp.), similar to that reported in the literature (Khuong-Huu-Laine *et al.*, 1966)

Crystal data

$C_{28}H_{50}N_2O$
M_r = 430.70
Triclinic, *P*1
a = 6.245 (3) Å
b = 7.106 (4) Å
c = 15.858 (8) Å
α = 77.993 (9)°
β = 87.575 (10)°
γ = 67.574 (8)°
V = 635.7 (6) Å^3
Z = 1
D_x = 1.125 Mg m^{-3}
Mo *Kα* radiation
μ = 0.07 mm^{-1}
T = 294 (2) K
Plate, colorless
0.45 × 0.38 × 0.10 mm

Data collection

Bruker SMART CCD area-detector diffractometer
φ and ω scans
Absorption correction: multi-scan (*SABABS*; Sheldrick, 1996)
T_{min} = 0.971, T_{max} = 0.993
3380 measured reflections
2224 independent reflections
1002 reflections with $I > 2\sigma(I)$
R_{int} = 0.042
θ_{max} = 25.0°

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.054
$wR(F^2)$ = 0.095
S = 1.00
2224 reflections
280 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0225P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.16 e Å^{-3}
$\Delta\rho_{min}$ = −0.16 e Å^{-3}

H atoms were positioned geometrically, with O—H = 0.82 Å, and C—H = 0.98, 0.97 and 0.96 Å for methine, methylene and methyl H, respectively, and constrained to ride on their parent atoms, with $U_{iso}(H) = xU_{eq}(C,O)$, where x = 1.2 for methine and methylene H, and x = 1.5 for all other H atoms. In the absence of significant anomalous scattering effects, Friedel pairs were merged; the absolute configuration is assigned arbitrarily.

Data collection: *SMART* (Bruker, 2000); cell refinement: *SMART*; data reduction: *SAINT* (Bruker, 2000); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *SHELXTL* (Bruker, 2000); software used to prepare material for publication: *SHELXTL*.

The authors thank Professor Da-Qi Wang for the crystal structure determination.

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