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20-Dimethylamino-3α-methylamino-5α-pregnane

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Key indicators

Single-crystal X-ray study
T = 293 K
Mean σ(C–C) = 0.004 Å
R factor = 0.058
wR factor = 0.159
Data-to-parameter ratio = 11.6

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

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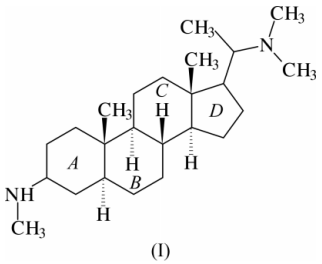
In the title molecule, $C_{24}H_{44}N_2$, also known as pachysamine A, all four rings are *trans* fused. The cylohexane rings adopt chair conformations and the cyclopentane ring a half-chair form. The methylamino and dimethylaminoethyl substituents are equatorially attached. The crystal structure is stabilized by van der Waals forces.

Comment

In the flora of Nepal, the genus *Sarcococca* is represented by four species (Hara *et al.*, 1982), which are important producers of steroidal alkaloids, of which *Sarcococca hookeriana* (*Baill.*) *Hook. F.* (*Buxaceae*), is one. *S. hookeriana* is an evergreen shrub, widely distributed from Eastern to Western Nepal, North Assam, South Tibet and Bhutan. Rural communities in Nepal have been using the root extracts of this plant against gout (Rajbhandari, 2002). Alkaloids from this plant have been reported to exhibit important biological activities such as antibacterial, anticholinesterase (Atta-ur-Rahman *et al.*, 1998, 2002), antitumor (Zou *et al.*, 1997), and antiulcer (Qiu *et al.*, 1994). The title compound, (I), has, for the first time, been isolated from the genus *Sarcococca hookeriana*. It was previously isolated from same family but from the different genus *Pachysandra terminalis* (*Buxaceae*). We report here the crystal structure of (I). The results may be useful in molecular modelling and docking studies of this potent triterpenoidal alkaloid with cholinesterases, which is the current interest of our research group.



(I)

The molecule contains a fused four-ring system *A*/*B*/*C*/*D*. The *A*/*B*, *B*/*C* and *C*/*D* ring junctions are *trans*-fused. In the steroid nucleus, the cyclohexane rings (*A*, *B* and *C*) adopt chair conformations, whereas the cyclopentane ring (*D*) exhibits a half-chair form. The methylamino substituent is attached equatorially to ring *A* [C1—C2—C3—N1 = 174.9 (2)°] and the C24—N1—C3—C2 torsion angle of 170.6 (3)° indicates a (+)-antiperiplanar conformation. The dimethylaminoethyl group is attached equatorially to ring *D*. The methyl substituents at atoms C10 and C13 are oriented to the same side of the steroid nucleus. The sum of the bond

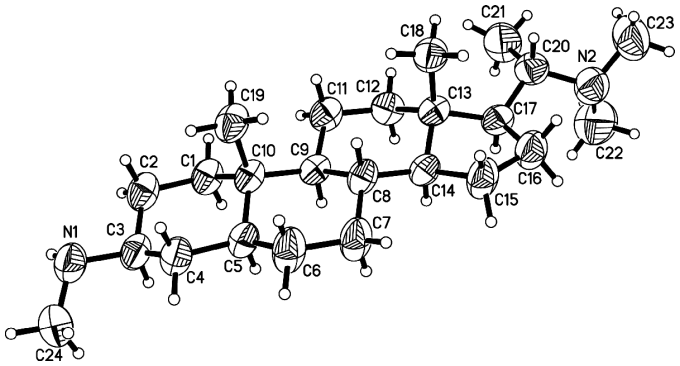


Figure 1
The structure of (I), showing 50% probability displacement ellipsoids and the atom-numbering scheme.

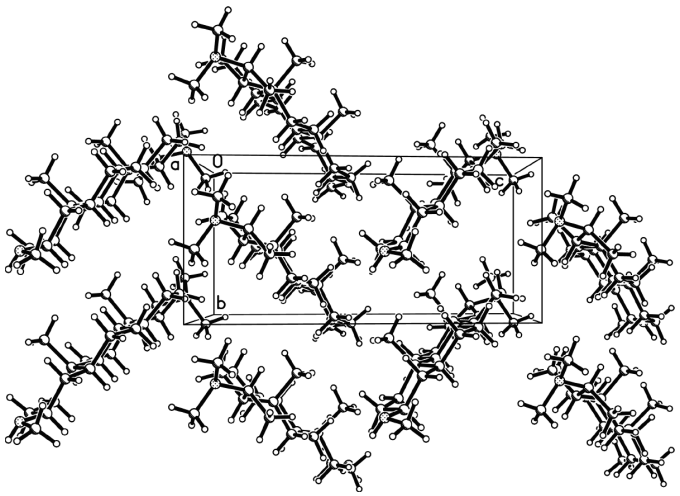


Figure 2
A view, down the *b* axis, of the molecular packing in (I).

angles around N1 (331.2°) and N2 (339.0°) is indicative of sp^3 character. The bond lengths in (I) show normal values (Allen *et al.*, 1987). In the crystal structure, the molecules are packed in zigzag manner, without any classical hydrogen bonds.

Experimental

Air-dried, whole plant (31.0 kg) of *Sarcococca hookeriana* was extracted with 80% methanol–water (120 l) over a period of 15 d at room temperature. The mixture was filtered and concentrated under reduced pressure. The concentrated methanolic aqueous extract (2.8 kg) was dissolved in distilled water (12 l) and defatted with petroleum ether (30 l). The aqueous layer was then extracted with dichloromethane (30 l) to obtain a neutral fraction (107.8 g). The aqueous fraction was then acidified with acetic acid (pH 3–4) and extracted with dichloromethane (30 l) to obtain the acidic fraction (85.0 g). Thereafter, the aqueous fraction was rendered basic with ammonia solution (pH 9–10) and extracted with dichloromethane to obtain the basic fraction of the plant (24.7 g). The alkaline fraction was adsorbed on silica gel (E. Merck, type 60, 70–230 mesh) and eluted with different gradients of petroleum ether and acetone. Elution with 25% acetone in petroleum ether afforded a sub-fraction (4.5 g) which was further chromatographed on a silica gel (E. Merck, flash, 234–300 mesh) column to afford pachsamine A, (I), after elution of petroleum ether–acetone–diethylamine (75:24:1) in 1.74×10^{-3}% yield (R_F = 0.46, 50% acetone: hexane + few drops of diethylamine). Compound (I) was recrystallized from petroleum ether–chloroform and acetone to yield block-shaped, colorless single crystals. The melting point of (I) is 444–447 K, similar to that reported in the literature (Tomita, 1964).

Crystal data

$C_{24}H_{44}N_2$
M_r = 360.61
Monoclinic, $P2_1$
a = 12.664 (3) Å
b = 6.4003 (15) Å
c = 13.801 (3) Å
β = 97.015 (5)°
V = 1110.2 (4) Å^3
Z = 2
D_x = 1.079 Mg m^{-3}
Mo $K\alpha$ radiation
Cell parameters from 2500 reflections
θ = 1.5–27.5°
μ = 0.06 mm^{-1}
T = 293 (2) K
Block, colourless
0.54 × 0.35 × 0.18 mm

Data collection

Siemens SMART CCD area-detector diffractometer
ω scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
T_{min} = 0.967, T_{max} = 0.989
7516 measured reflections
2766 independent reflections
2192 reflections with $I > 2\sigma(I)$
R_{int} = 0.021
θ_{max} = 27.5°
$h = -16 \rightarrow 11$
$k = -8 \rightarrow 8$
$l = -17 \rightarrow 17$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.058
$wR(F^2)$ = 0.159
S = 1.05
2766 reflections
238 parameters
H atoms treated by a mixture of independent and constrained refinement
$w = 1/[\sigma^2(F_o^2) + (0.0963P)^2 + 0.0365P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.001
$\Delta\rho_{max}$ = 0.22 e Å^{-3}
$\Delta\rho_{min}$ = −0.19 e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

N1—C24	1.436 (4)	N2—C22	1.437 (6)
N1—C3	1.465 (3)	N2—C20	1.464 (4)
N2—C23	1.430 (5)		
C24—N1—C3	114.2 (2)	C23—N2—C20	112.9 (3)
C23—N2—C22	112.1 (3)	C22—N2—C20	114.0 (3)
C24—N1—C3—C4	−66.4 (4)	C22—N2—C20—C21	−54.8 (4)
C24—N1—C3—C2	170.6 (3)	C23—N2—C20—C17	−157.6 (3)
C23—N2—C20—C21	74.6 (4)	C22—N2—C20—C17	73.1 (3)

All H atoms were located in a difference map. The C-bound H atoms were refined using a riding model [C—H = 0.96–0.98 Å] with U_{iso} constrained to be $1.5U_{eq}$ of the carrier atom for the methyl groups and $1.2U_{eq}$ for the remaining atoms. Both positional and isotropic displacement parameters of the amine H atom, H1, were refined [N—H = 0.84 (4) Å]. The Friedel reflections were merged before the final refinement because of the absence of significant anomalous scattering effects.

Data collection: *SMART* (Siemens, 1996); cell refinement: *SAINT* (Siemens, 1996); data reduction: *SAINT*; program(s) used to solve structure: *SHELXTL* (Sheldrick, 1997); program(s) used to refine structure: *SHELXTL*; molecular graphics: *SHELXTL*; software used to prepare material for publication: *SHELXTL, PARST* (Nardelli, 1995) and *PLATON* (Spek, 2003).

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In the paper by Choudhary *et al.* [*Acta Cryst.* (2003), E**59**, o1682–o1684], there is an error in the title. The correct title should read '20-Dimethylamino-3β-methylamino-5α-pregnane'.