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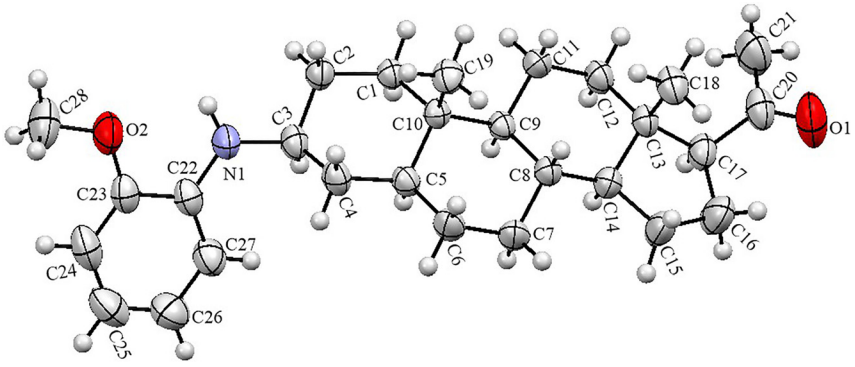
Synthesis and crystal structure of 1-((3*R*,10*S*,13*S*,17*S*)-3-((2-methoxyphenyl)amino)-10,13-dimethylhexadecahydro-1*H*-cyclopenta[*α*]phenanthren-17-yl)ethan-1-one, $C_{28}H_{41}NO_2$



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Abstract

$C_{28}H_{41}NO_2$, monoclinic, *C*2 (no. 5), a = 4.8622(5) Å, b = 6.7853(7) Å, c = 14.3349(17) Å, β = 96.556(3)°, V = 469.84(9) Å^3, Z = 2, $R_{gt}(F)$ = 0.0482, w$R_{ref}(F^2)$ = 0.1257, T = 284(2) K.

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The molecular structure is shown in the figure. Table 1 contains crystallographic data and Table 2 contains the list of the atoms including atomic coordinates and displacement parameters.

Table 1: Data collection and handling.

Crystal:	Colorless block
Size:	0.24 × 0.21 × 0.19 mm
Wavelength:	Mo *K*α radiation (0.71073 Å)
μ:	0.07 mm^{-1}
Diffractometer, scan mode:	Bruker APEX-II, φ and ω
θ_{max}, completeness:	28.3°, >99 %
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	12,227, 5952, 0.026
Criterion for I_{obs}, $N(hkl)_{gt}$:	I_{obs} > 2 σ(I_{obs}), 4234
$N(param)_{refined}$:	284
Programs:	Olex2 [1], Bruker [2], SHELX [3], Diamond [4]

1 Source of material

An amount of 1.6 mmol of 5α-pregnane-3,20-dione was weighed and placed in a 25 ml round-bottom flask. 1.3 mmol of 2-methoxyaniline, a drop of acetic acid, and 10 ml of methanol were added. The mixture was stirred for 24 h at room temperature, then 3.9 mmol of $NaBH_4$ was slowly added, which was further allowed to stir for 3 h. At the end of the reaction, the reaction mixture was extracted by ethyl acetate and washed with brine. In addition, the combined organic layers were dried with anhydrous magnesium sulfate. After filtration, the colorless bulk crystal of the title compound was obtained by crystallization of the crude product in methanol with a yield of 56 %. **Elemental analysis** calcd. (%) for $C_{28}H_{41}NO_2$: C, 79.39; H, 9.76; N, 3.31; O, 7.55 Found: C, 79.39; H, 9.76; N, 7.55.

2 Comment

Plants of the species *Sarcococca ruscifolia* of Buxaceae are widely used as ethno medicine in many parts of China. With the effect of cooling blood and removing stasis, detoxifying sores, and so on, it is mainly used to treat common ailments such as stomach pain, bruises, rheumatic pain, sore throat,

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Table 2: Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2).

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
C1	0.43207 (14)	0.8093 (4)	0.55972 (13)	0.0416 (6)
C2	0.38051 (15)	0.8175 (4)	0.47965 (14)	0.0469 (6)
C3	0.36641 (15)	0.6223 (4)	0.44556 (14)	0.0470 (6)
C4	0.33459 (15)	0.5011 (4)	0.49708 (15)	0.0492 (7)
C5	0.38900 (14)	0.4859 (4)	0.57476 (14)	0.0417 (6)
C6	0.36778 (16)	0.3424 (4)	0.62600 (15)	0.0535 (7)
C7	0.43023 (17)	0.3101 (4)	0.69678 (15)	0.0528 (7)
C8	0.45648 (14)	0.4929 (4)	0.73926 (14)	0.0412 (6)
C9	0.47326 (13)	0.6412 (4)	0.68546 (13)	0.0365 (5)
C10	0.40836 (12)	0.6778 (3)	0.61488 (13)	0.0369 (5)
C11	0.50508 (15)	0.8187 (4)	0.72901 (14)	0.0474 (6)
C12	0.57147 (15)	0.7794 (4)	0.79571 (14)	0.0481 (7)
C13	0.55381 (13)	0.6364 (4)	0.84986 (13)	0.0412 (6)
C14	0.52455 (15)	0.4607 (4)	0.80388 (14)	0.0455 (6)
C15	0.5240 (2)	0.3143 (5)	0.86362 (17)	0.0684 (9)
C16	0.5936 (2)	0.3546 (5)	0.9262 (2)	0.0796 (11)
C17	0.62027 (16)	0.5485 (4)	0.90940 (16)	0.0530 (7)
C18	0.50089 (16)	0.7186 (5)	0.89049 (16)	0.0581 (8)
C19	0.34417 (14)	0.7648 (4)	0.63701 (15)	0.0498 (7)
C20	0.65128 (16)	0.6643 (5)	0.97901 (16)	0.0612 (8)
C21	0.6910 (2)	0.8388 (6)	0.9706 (2)	0.0870 (12)
C22	0.31146 (15)	0.4775 (4)	0.31996 (15)	0.0499 (7)
C23	0.25989 (16)	0.4922 (5)	0.24953 (15)	0.0534 (7)
C24	0.24557 (19)	0.3426 (6)	0.20059 (17)	0.0674 (9)
C25	0.2828 (2)	0.1762 (6)	0.2199 (2)	0.0786 (11)
C26	0.3336 (2)	0.1594 (5)	0.28754 (19)	0.0723 (9)
C27	0.34835 (17)	0.3084 (5)	0.33742 (17)	0.0602 (8)
C28	0.1777 (2)	0.6951 (7)	0.16506 (17)	0.0862 (12)
H2	0.661395	0.945604	0.973236	0.131*
H3	0.137891	0.609508	0.157979	0.129*
H4	0.160037	0.821298	0.162541	0.129*
H5	0.210756	0.353357	0.154327	0.081*
H6	0.358590	0.047270	0.300269	0.087*
H7	0.383455	0.295567	0.383368	0.072*
H8	0.323580	0.377424	0.475218	0.059*
H9	0.289996	0.556669	0.501999	0.059*
H10	0.511814	0.588062	0.666187	0.044*
H11	0.518675	0.905141	0.694524	0.057*
H12	0.468116	0.878718	0.747834	0.057*
H13	0.610571	0.732303	0.776767	0.058*
H14	0.491246	0.627401	0.924876	0.087*
H15	0.456473	0.751572	0.853905	0.087*
H16	0.521796	0.828240	0.918139	0.087*
H17	0.583856	0.354358	0.975329	0.095*
H18	0.481613	0.327857	0.882290	0.082*
H19	0.524649	0.188830	0.843605	0.082*
H19A	0.330960	0.686264	0.673498	0.075*
H19B	0.303799	0.776310	0.592886	0.075*
H19C	0.357502	0.886467	0.658517	0.075*
H20	0.562127	0.421453	0.780169	0.055*
H21	0.414636	0.224690	0.730252	0.063*
H22	0.470185	0.252007	0.682416	0.063*
H23	0.355179	0.225243	0.598885	0.064*
H24	0.325666	0.386422	0.640469	0.064*
H25	0.272953	0.075504	0.186631	0.094*
H25A	0.418242	0.541013	0.760253	0.049*
H26	0.629850	0.260148	0.926222	0.095*
H27	0.701835	0.837642	0.922598	0.131*
H28	0.735197	0.845579	1.010512	0.131*
H29	0.658711	0.529198	0.884374	0.064*
H30	0.587578	0.895069	0.822747	0.058*
H31	0.401543	0.895274	0.447879	0.056*
H32	0.335052	0.873818	0.481501	0.056*
H33	0.437269	0.934605	0.580819	0.050*
H34	0.479335	0.769593	0.556135	0.050*
H35	0.433881	0.439282	0.565624	0.050*
H36	0.413321	0.568303	0.445517	0.056*
H37	0.201639	0.675890	0.126090	0.129*
N1	0.32281 (14)	0.6311 (4)	0.36781 (12)	0.0573 (6)
H1	0.303119	0.735981	0.350568	0.069*
O1	0.64665 (15)	0.6177 (5)	1.04051 (12)	0.0987 (10)
O2	0.22699 (12)	0.6638 (4)	0.23622 (11)	0.0710 (7)

etc. [5]. For example, in the Miao region of Guizhou, the unilateral prescription of this species is often used to treat Alzheimer's disease [6]. Modern studies have revealed that *S. ruscifolia* plants are rich in pregnane-type alkaloids, which have a variety of pharmacological activities [7–11]. In order to find high-efficiency, low-toxicity, and safe alkaloid derivatives, we used 5α-pregnane-3,20-dione as the substrate for derivatization. As a result, we introduced *o*-methylaniline at the C-3 position to obtain the title compound. This study has explored new ideas for the subsequent research of this type of alkaloid.

The compound consists of one keto, two methyls, one *o*-methoxyaniline, and four rings of A, B, C, and D of the steroid parent nucleus. The A/B and C/D rings in the mother nucleus are all *cis*-fused. The B/C rings are *trans*-fused, and the substituents on positions C-10, C-13, and C-17 are all in β configurations. The *o*-methoxyaniline system at position C-3 is in a α configuration. The bond length and bond angle of the compound are within the normal range [11]. The *o*-methoxyaniline system is planar, and the carbonyl is confirmed by the distance *d* (C20–O1) = 1.204(4) Å. The five membered ring and three six membered rings show intermolecular interactions by van der Waals forces only.

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Conflict of interest statement: The authors declare no conflicts of interest regarding this article.

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