

15 α -Acetoxycleomblynnol A from *Cleome amblyocarpa*

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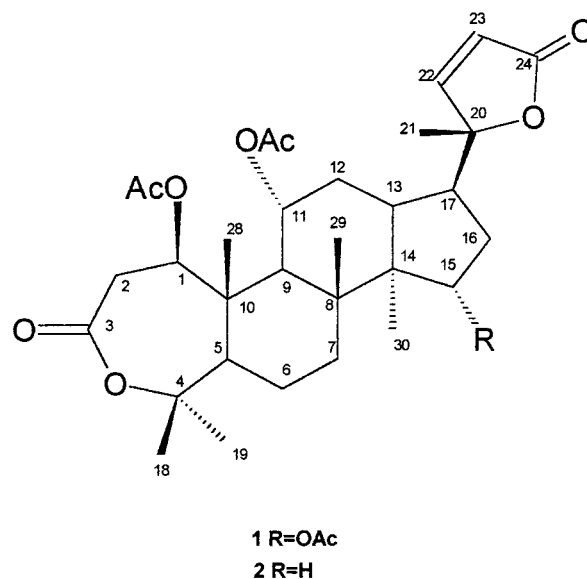
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Reinvestigation of the MeOH–CH₂Cl₂ extract of the aerial parts of *Cleome amblyocarpa* led to isolation of a new dammarane triterpenoid, 15 α -acetoxycleomblynnol A, whose structure was determined to be 11 α ,15 α -diacetoxycleomblynnol A by NMR data interpretation and X-ray analysis.

Cleome amblyocarpa Barratte et Murb. (Capparidaceae),¹ found in the Middle East, has been used ethnomedically to treat rheumatic fever, inflammation, and scabies.² Extracts of the aerial parts of *C. amblyocarpa* are reported to have analgesic and antiinflammatory activity³ and to have shown cytotoxicity to KB cancer cells,⁴ but displayed neither antimicrobial⁵ nor antihyperglycemic activity.⁶ Previous studies have identified several dozen flavonoids, steroids, fatty acids, and terpenoids,^{3–9} including four new triterpenoids.² In a recent paper,¹⁰ the structure of one of these, cleomblynnol A, was revised from that reported earlier² to **2** on the basis of X-ray analysis.

Reinvestigation of the aerial parts of *C. amblyocarpa* afforded a new triterpenoid, **1**, whose NMR data (Table 1) were very similar to those of **2** except for the presence of three instead of two acetate groups. In addition, as shown by an APT experiment, one of the methylene groups of **2** was replaced by an oxygenated methine group resonating at δ 72–74. These results are consistent with **1** being an acetoxy derivative of **2**. This hypothesis was supported by the HRCIMS, which gave an MH⁺ for the molecular formula C₃₃H₄₆O₁₀.

The location of the new acetate group in **1** was shown to be at C-15 by a combination of COSY, HMQC, and HMBC 2D NMR experiments (Table 1). The former established the connectivity around the oxygenated methine groups at C-1, C-11, and C-15 and showed that the last of these correlated with the C-16 methylene and the C-17 and C-13 methine groups. The HMQC and HMBC experiments showed correlations among all the remaining positions except the acetate methyl groups and C-6, which was deduced by difference. The only structural feature not answered by NMR was the relative stereochemistry of the 15-acetate group. When compared to the ¹³C NMR spectrum of **2**,¹⁰ the high-field shift of one of the methyl groups to δ 10.5 suggests that it experienced a steric compression shift from the new acetate group. An inspection of Dreiding models, however, indicated this could be the methyl group at either the 29- or the 30-position, depending on whether the acetate group has the β - or α -configuration, respectively. The latter was shown to be correct by X-ray analysis (Figure 1), thus confirming **1** as 15 α -acetoxycleomblynnol



A, or 11 α ,15 α -diacetoxycleomblynnol A. A table of crystal data for **1** is included as Supporting Information.

The complete assignment of the ¹³C NMR peaks for **1** as shown in Table 1 requires reassignments in the ¹³C NMR spectra of **2** for which no HMBC experiments had been obtained earlier.¹⁰ The suggested revisions (see Table 2 of the Supporting Information) are based on comparisons between **1** and **2** and on the known chemical shift differences of methylcyclopentane and *cis*-2-methylcyclopentyl acetate.¹¹

Experimental Section

General Experimental Procedures. NMR spectra were obtained on a Varian 400 Unity Inova instrument operating at 399.97 MHz (¹H) or 100.58 MHz (¹³C) in CDCl₃ and are reported in ppm downfield from TMS at δ 0, with multiplicity (s, d, dd, m, br s) and observed couplings (*J* in Hz) determined. The IR spectrum was obtained on a Midac FT-IR and the [α]_D on a JASCO DIP-370 polarimeter. The HRCIMS spectrum was obtained on a Micromass (Manchester, GB) VG-ZAB-E high-resolution double-sector mass spectrometer operating at an ionization voltage of 70 eV with methane as the reagent gas.

Plant Material. The aerial parts of *C. amblyocarpa* were collected near the town of El-Aresh in the southern Sinai desert, Egypt, in April 1994, by one of us (A.A.A.). A voucher specimen (Ahmed 74/94) has been deposited in the Department of Botany, Faculty of Science, El-Minia University.

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Table 1. NMR Data for Compound **1**

position	δ_C	APT	δ_H (mult., J in Hz.)	COSY	HMBC (C—H)
1	78.7	CH	5.16 br d (4.7)	2a, 2b 2a, 2b, 28	
2	37.0	CH ₂	b3.19 dd (15.6, 5.6) a2.91 br d (15.3)	1, 2a	
3	172.0	C			1, 2a, 2b
4	84.4	C			18, 19
5	53.4	CH	1.97 m		19, 28
6	23.3	CH ₂	1.74 m 1.45 m		
7	34.7	CH ₂	1.30 m 1.60 m		29
8	50.6	C			15, 29, 30
9	51.1	CH	1.92 m	11	1, 28
10	43.8	C			1, 2b, 28
11	72.0	CH	5.09 ddd (11, 11, 4.7)	9, 12a, 12b	
12	33.4	CH ₂	1.53 m 1.90 m	11	
13	39.7	CH	1.80 m	17	30
14	41.9	C			15, 29, 30
15	73.3	CH	4.91 dd (9.2, 7.2)	16a, 16b	30
16	32.5	CH ₂	b1.65m a2.05 m	15, 17	
17	44.6	CH	2.17 m	13, 16b	
18	26.5	Me	1.40 s		
19	30.3	Me	1.47 s		18
20	90.4	C			21, 22, 23
21	23.4	Me	1.42 s		
22	158.3	CH	7.39 d (5.7)	23	23
23	121.9	CH	6.11 d (5.7)	22	
24	171.6	C			22, 23
28	14.4	Me	1.20 s		
29	17.3	Me	1.17 s		
30	10.5	Me	1.09 s		
Ac-1	170.37	C			1
Me-1 ^a	21.7	Me	2.008 s		
Ac-11	170.45	C			11
Me-11 ^a	21.4	Me	1.95 s		
Ac-15	170.47	C			15
Me-15 ^a	21.2	Me	2.012 s		

^a These assignments may be interchanged.

Extraction and Isolation. The plant material (1.3 kg) was extracted with MeOH–CH₂Cl₂ (1:1) to give 30 g of a gummy extract, which was fractionated by flash chromatography on Si gel. The *n*-hexane–CH₂Cl₂ (1:3) fraction was further separated by passage over Sephadex LH-20 (*n*-hexane–CH₂Cl₂–MeOH, 4:2:1) to give 40 mg of compound **1**: mp 259.5–262 °C; $[\alpha]_D^{25} +29.7^\circ$ (*c* 0.17, CHCl₃); IR (film) ν_{\max} 2982, 2934, 1736 (br s), 1383, 1246, 1117 cm⁻¹; ¹H and ¹³C NMR, see Table 1; HRCIMS *m/z* 603.31433 (MH⁺) (calcd for C₃₃H₄₇O₁₀, 603.31692).

Crystal Structure of 1. X-ray data were collected at 213 K on a Bruker 1000 CCD SMART system diffractometer using graphite monochromated Mo K α radiation ($\lambda = 0.71073$). A total of 567 frames were collected at a scan width of 0.3° and an exposure time of 10 s/frame. The frames were integrated with the SAINT program package¹² using a narrow-frame algorithm. The structure was solved and refined using SHELXL-TL.¹³ No absorption correction was made.¹⁴

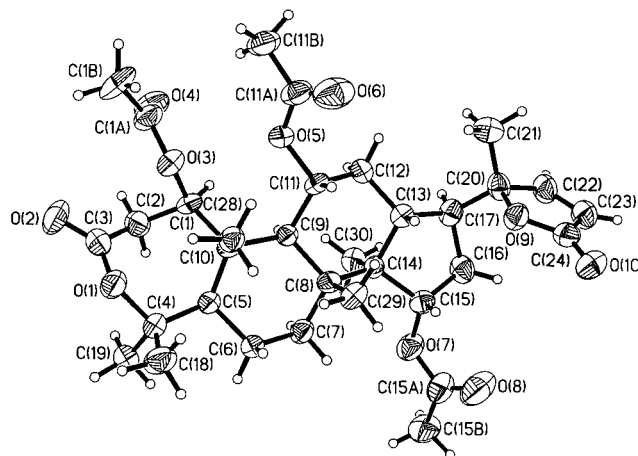


Figure 1. Perspective structure of **1** as a 35% thermal ellipsoid probability plot.

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Supporting Information Available: Tables of crystal data for **1** and of known ¹³C NMR data for **2** with revised assignments are available free of charge via the Internet at <http://pubs.acs.org>.

References and Notes

- (1) *C. africana* Botsch. is claimed to be a synonym of *C. amblyocarpa* (Harraz et al.²), but *Index Kewensis* indicates these to be separate.
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- (12) SAINT Version 6.02; Bruker AXS, Inc., 1997–1999.
- (13) SHELXL Version 5.1; Bruker AXS, Inc., 1997–1999.
- (14) Crystallographic data for compound **1** (with the numbers for C-22 and C-24 reversed) have been deposited with the Cambridge Crystallographic Data Centre. Copies of the data can be obtained, free of charge, on application to the Director, CCDC, 12 Union Road, Cambridge CB2 1EZ, UK [Fax: +44-(0)1223-336033 or e-mail: deposit@ccdc.cam.ac.uk].

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