14-Hydroxychapparinone, a New Quassinoid from Hannoa chlorantha

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14-HYDROXYCHAPPARINONE, A NEW QUASSINOID FROM *HANNOA CHLORANTHA*

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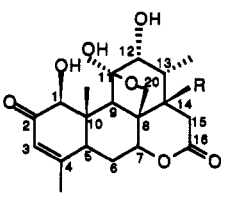
ABSTRACT.—14-Hydroxychapparinone [**1**] has been isolated from *Hannoa chlorantha* together with five known quassinoids: undulatone, desacetylundulatone, chapparinone, klaineanone, and 11-dehydroklaineanone. The structure of the new quassinoid **1** was determined from spectroscopic data.

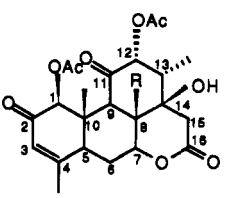
Eight alkaloids from *Hannoa chlorantha* Planch. (Simaroubaceae), a shrub used in Angolese traditional medicine, have been reported previously (1). Reported herein is the structure determination of a new quassinoid **1** isolated from the seeds and five known quassinoids extracted from the roots and seeds of this plant.

Compound **1** was isolated from a polar fraction of an EtOH crude extract, and its structure was elucidated using spectroscopic methods with reference to previously reported data (2–8).

Compound **1** crystallized from MeOH; its molecular formula was $C_{20}H_{26}O_8$ as deduced from the mass spectral data (fabms *m/z* 417 $[M+Na]^+$). No substantial absorption was observed in the uv spectrum, but the ir spectrum displayed absorptions at 3475 cm^{-1} (hydroxyl), 2890 cm^{-1} (CH), 1699 cm^{-1} (lactone), 1669 cm^{-1} (carbonyl), and 1617 cm^{-1} (double bond) (3,9). The ^{1}H- and ^{13}C-nmr spectra exhibited signals characteristic of the quassinoid skeleton (Table 1). These spectra were unambiguously assigned through homonuclear (COSY) and heteronuclear (HMQC) correlations spectroscopy. By comparison of the chemical shift values and the coupling constants with those reported for known compounds (2–11), it was evident that the structure of **1** was closely related to that of chapparinone [**3**]. However, in the ^{1}H-nmr spectrum, the multiplet corresponding to H-14 of chapparinone was absent, as substantiated by the following arguments. In the COSY spectrum of **1**, H-13 (δ 1.98) showed correlations only with H-12 (δ 3.14) and 13-Me (δ 0.87) protons; in addition the H-15 protons were coupled solely to each other. Furthermore, from the ^{13}C-nmr data (BBD, DEPT, and HMQC), the quaternary nature of C-14 was obvious. The following features indicated that C-14 was substituted by an hydroxyl. The molecular ion of **1** differed from that of chapparinone by one additional oxygen atom. The signals



1 R=OH
3 R=H



2 R=CH_2OAc

TABLE 1. ^{1}H- and ^{13}C-nmr Chemical Shift Values of Compounds **1**, **2**, and **3** in ppm from TMS.

Position	^{1}H nmr					^{13}C nmr		
	Compound					Compound		
	1[a]	**1**[b]	**2**[c]	**3**[a]	**3**[b]	**1**[a]	DEPT	**1**[b]
1	4.51 (s)	4.23 (s)	5.31 (s)	4.36 (s)	4.20 (s)	85.24	CH	82.65
2	—	—	—	—	—	197.60	C	197.17
3	6.20 (d, 1.3)	6.99 (s)	6.02 (s)	6.09 (br s)	5.99 (br s)	126.63	CH	124.88
4	—	—	—	—	—	163.17	C	162.62
5	3.23 (br d, 8.9)	2.67 (br d, 12.20)	3.0 (d, 11.0)	3.05 (br d, 12.70)	2.80 (br t)	41.34	CH	40.95
	2.11 (ddd, 14.7, β)[d]	2.06 (d, 14.84)	2.08 (m)[d]	1.92 (m)[e]	2.00 (m)[e]			
6						26.51	CH_2	24.81
	2.40 (ddd, 14.6, 8.5, 2.5, α)	2.85 (d, 14.84)	2.26 (ddd, 14.8, 8.5, 3.2)	2.49 (m)[f]	2.00 (m)[e]			
7	3.55 (m)	5.07 (d, 5.27)	4.81 (br s)	5.49 (br s)	4.47 (br s)	76.07	CH	73.49
8		—	—	—	—	51.55	C	49.48
9	3.45 (s)	2.52 (s)	3.29 (s)	3.29 (s)	2.59 (s)	48.05	CH	45.97
10	—	—	—	—	—	46.19	C	44.54
11	—	—	—	—	—	110.50	C	108.30
12	4.12 (d, 5.0)	3.14 (dd, 9.88, 4.94)	5.17 (d, 4.3)	3.96 (d, 4.12)	3.19 (d, 4.00)	79.01	CH	76.75
13	2.80 (m)	1.96 (m)	2.86 (m)	2.48 (m)	2.10 (m)	38.87	CH	36.83
14	—	—	—	2.12 (m)	2.00 (m)	75.30	C	74.43
	3.30 (d, 18.0, H-15β)	2.30 (d, 18.13)	3.00 (d, 18.7)	2.84 (dd, 18.75; 5.20)	2.40 (dd, 18.78; 5.07)			
15						38.87	CH_2	36.78
	3.77 (d, 18.0, H-15α)	2.83 (d, 18.16)	3.60 (d, 18.7)	3.40 (dd, 18.75; 4.80)	2.66 (dd, 18.78; 4.5)			
16	—	—	—	—	—	171.01	C	169.74
4-Me	1.86 (s)	1.92 (s)	1.89 (s)	1.74 (s)	1.92 (s)	22.90	Me	22.30
13-Me	1.46 (d, 7.0)	0.87 (d, 6.9)	1.10 (d, 7.0)	1.10 (d, 7.16)	0.86 (d, 7.01)	10.90	Me	9.56
10-Me	1.69 (s)	1.06 (s)	1.39 (s)	1.54 (s)	1.08 (s)	10.73	Me	9.47
	4.15 (d, 9.5)	3.62 (d, 8.90)	4.47 (d, 12.5)	3.74 (d, 8.48)	3.51 (d, 8.50)			
-O-CH_2						67.40	CH_2	65.30
	4.64 (d, 9.5)	3.85 (d, 8.90)	4.51 (d, 12.5)	4.12 (d, 8.48)	3.84 (d, 8.50)			
OAc	—	—	1.95 (s)					
			2.03 (s)					
			2.14 (s)					

[a]Spectra recorded in pyridine-d_5.
[b]Spectra recorded in DMSO-d_6.
[c]Spectrum recorded in pyridine-d_5/$CDCl_3$.
[d]This signal partially overlapped with the 4-Me singlet.
[e]This signal overlapped with the H-14 multiplet.
[f]This signal overlapped with the H-13 multiplet.

corresponding to the protons at C-13 and C-15, and to 13-Me, were shifted downfield (3,5,9). In the ^{13}C-nmr spectrum of **1**, in DMSO-d_6, the signals corresponding to chemical shifts of all C-14 neighboring carbons (13-Me, C-15, C-13, C-8, C-7, and C-20) were shifted in comparison with those of **3** (5). Finally, acetylation of **1** afforded a 1,12,20-tri-*O*-acetyl derivative, **2** (fabms *m/z* 543 $[M+Na+H]^+$, 521 $[M+H]^+$), confirming the tertiary nature of the additional hydroxyl in **1** and providing further evidence for its location at C-14. These data allowed the structural assignment of **1** as 14-hydroxychapparinone.

The identification of the known quassinoids was achieved by comparison of their spectroscopic data (uv, ir, nmr, and ms) with those previously reported (2–7) and by chromatographic comparisons with authentic quassinoid samples isolated from *Hannoa klaineana* (2–4).

The main root quassinoids were undulatone, desacetylundulatone, and chapparinone; undulatone was concentrated in the root bark whereas desacetylundulatone was concentrated in the inner parts of the root.

The major quassinoid of the seeds was chapparinone; klaineanone, 11-dehydroklaineanone, undulatone, and the new quassinoid **1** were found in lower concentrations.

EXPERIMENTAL

GENERAL EXPERIMENTAL PROCEDURES.—Uv spectra were recorded in EtOH. Ir spectra were measured using KBr discs. ^1H and ^{13}C nmr were obtained on a Bruker WM-250 spectrometer, and on a VARIAN-Unity 600 for the 2D spectra. The DEPT sequence was used to determine the number of protons on the different carbon atoms; one-bond ^1H-^{13}C and ^1H-^1H connectivities were determined via the 2D proton-detected HMQC and COSY experiments, respectively. Chemical shift data are in ppm downfield from TMS. Eims were recorded by direct inlet at 70 eV, and fabms were obtained using glycerol as matrix.

PLANT MATERIAL.—Seeds and roots of *H. chlorantha* were collected in 1991 at Savipanda in the region of Kuando Kubango (Angola). The plant was identified by direct comparison with voucher specimens (Nr 1329, 1285, and 1484) deposited at the National Botanical Garden, Meise, Belgium. A voucher specimen was deposited at the BRLU-Herbarium, Laboratoire de Botanique, Systématique et Phytosociologie of U.L.B.

ISOLATION.—Dried ground root barks of *H. chlorantha* (400 g) were extracted with petroleum ether, then with EtOH. The EtOH extract was evaporated and the residue was suspended in H_2O and successively extracted with $CHCl_3$, EtOAc, and *n*-BuOH. The $CHCl_3$ and EtOAc extracts were pooled (2.5 g) and chromatographed on a Si gel column using as eluents *n*-hexane followed by $CHCl_3$ containing increasing amounts of MeOH. The fractions containing quassinoids were concentrated and subjected to cc on reversed-phase Si gel (C-18) using H_2O-MeOH (8:2) as eluent; quassinoids were then purified by preparative tlc on Si gel with $CHCl_3$-EtOAc-MeOH (16:3:1) as solvent system. This procedure gave the main quassinoids: undulatone (28 mg), desacetylundulatone (16 mg), and chapparinone (8 mg). Using the same experimental conditions, undulatone (20 mg), desacetylundulatone (30 mg), and chapparinone (12 mg) were obtained from 400 g of the inner part of the root. The seeds (300 g) were also processed as above. The quassinoid fraction (500 mg) resulting from the reversed-phase Si gel cc was separated by high speed countercurrent chromatography (hsccc) using the Ito apparatus coupled to a Camag device for on-line sampling of the effluent for tlc analysis (12); the solvent system was $CHCl_3$-MeOH-H_2O (50:60:20) with the upper layer as stationary phase and the lower layer as mobile phase. The eluted fractions and the quassinoids retained in the stationary phase were further purified by preparative tlc on Si gel with $CHCl_3$-Me_2CO-MeOH (16:3:1) as mobile phase. This procedure resulted in the isolation, from the eluted fractions, of the four known quassinoids: klaineanone (8 mg), 11-desacetylundulatone (6 mg), undulatone (4 mg), chapparinone (22 mg), and from the stationary phase, a new quassinoid: 14-hydroxychapparinone (8 mg).

14-Hydroxychapparinone [**1**].—White powder: needles from MeOH; uv (MeOH) λ max nm 238.1 (ε 11000); ir (KBr) ν max cm^{-1} 3475–2890, 1699, 1669, 1617; ^1H and ^{13}C nmr see Table 1, fabms *m/z* (rel. int. %) $[M+Na]^+$ 417 (19), 371 (46), 365 (24), 349 (70).

14,20-Dihydroxyklaineanone triacetate [**2**].—Fabms *m/z* (rel. int. %) $[M+Na+H]^+$ 543 (25), $[M+H]^+$ 521 (33), 479 (38), 435 (29), 419 (2), 377 (63), 364 (83); ^1H nmr see Table 1.

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