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TWO NEW PRIEURIANIN-CLASS LIMONOIDS
FROM *TURRAEA MOMBASANA*

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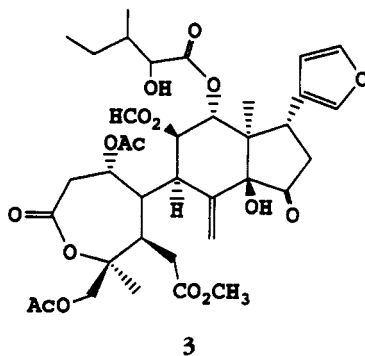
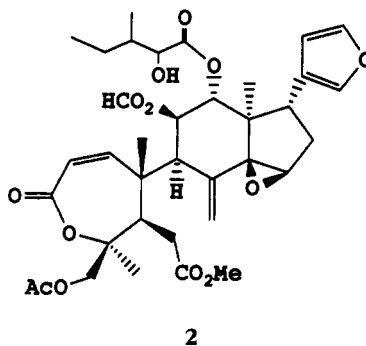
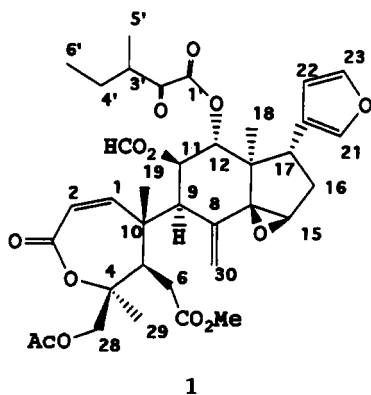
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ABSTRACT.—From the rootbark of *Turraea mombasana*, two new limonoids, **1** and **2**, of the prieurianin class have been isolated and their structures established by spectroscopic means.

Turraea mombasana C. DC. (Meliaceae) is a shrub found in East Africa. In traditional medicine, the roots are used for the treatment of excess bile and as an emetic; a decoction of the roots is

taken for the treatment of malaria and other fevers (1). Our investigation of the MeOH extract of the root bark has resulted in the isolation of two new limonoids **1** (mombasone) and **2**



(mombasol). Both are related to the known limonoid, prieurianin (**3**), isolated from *Trichilia prieuriana* (2), and to other B-ring-cleaved limonoids, for example, rohitukin from *Aphanamixis polistacha* (3) as well as nymanias 3 and 4 from *Nyamia capensis* (4).

The ^1H -nmr spectra of both **1** and **2** (Table 1) indicate the presence of a β -substituted furan, an acetate, a formate, a carbomethoxy, an epoxide, and three tertiary methyls. These observations are consistent with the assignment of **1** and **2** to the oxidized tetranortriterpene, or limonoid, class expected from consideration of Meliaceae chemotaxonomy. The molecular formulas of **1** ($\text{C}_{36}\text{H}_{44}\text{O}_{13}$) and **2** ($\text{C}_{36}\text{H}_{46}\text{O}_{13}$) are also consistent with the limonoid C_{26} skeleton if a C_6 side chain is

additionally present in each. A pair of singlets at 5.40 and 5.25 ppm in **1** and at 5.37 and 5.23 ppm in **2**, together with the carbomethoxy in both **1** and **2**, are typical of the terminal C-30 vinyl protons and C-7 oxidation characteristic of the B-ring-cleaved limonoids of the prieurianin class previously reported in the genera *Turraea* (5), *Trichilia* (2), and *Guarea* (6).

The ^1H -nmr spectra of both **1** and **2** are very similar to that reported for **3**, with the apparent differences being in the A and D rings. ^1H - and ^{13}C -nmr spectra of **1** and **2** indicate the presence of an A-ring α,β -unsaturated lactone, while **3** bears a 1α -acetate. Additionally, the ^1H spectra of **1** and **2** are consistent with the commonly observed 14,15-epoxide,

TABLE 1. ^1H -nmr Data for Compounds **1** and **2**.

Proton	Compound	
	1	2
H-1	6.90 d (14.0)	6.92 d (13.0)
H-2	6.30 d (14.0)	6.30 d (13.0)
H-5	3.40 d (7.8)	3.38 d (8.0)
H-6	2.30 m	2.29 m
H-9	3.15 d (7.3)	3.11 d (7.3)
H-11	5.75 d, d (7.2, 7.2)	5.75 d, d (7.2, 7.2)
H-12	5.95 d (7.2)	6.01 d (7.3)
H-15	3.90 s	3.87 s
H-16 α	2.30 m	2.29 m
H-16 β	1.85 d, d (10.1, 11.5)	1.80 d, d (10.9, 11.6)
H-17	3.05 d, d (10.1, 7.1)	3.05 d, d (10.9, 7.2)
H-18	0.89 s	0.91 s
H-19	0.89 s	0.95 s
H-21	7.10 s	7.08 s
H-22	6.15 s	6.12 s
H-23	7.27 t (1.6, 1.7)	7.29 t (1.6, 1.7)
H _a -28	4.65 d (12.0)	4.67 d (11.8)
H _b -28	4.30 d (12.0)	4.32 d (11.8)
H-29	1.40 s	1.31 s
H _a -30	5.40 s	5.37 s
H _b -30	5.25 s	5.23 s
OMe	3.70 s	3.70 s
OAc	2.05 s	2.06 s
H-11'	8.05 s	8.01 d (0.6)
H-2'	—	3.38 m
H-3'	2.75 m	1.45 m
H _a -4'	1.49 m	1.15 m
H _b -4'	1.15 m	1.00 m
H-5'	0.91 d (7.1)	0.84 d (6.8)
H-6'	0.75 t (7.0, 7.4)	0.77 t (7.3, 7.4)

while in **3**, this moiety has been opened and further oxidized. It has been reported (2) that the ^1H -nmr spectrum of **3** is broadened due to a rotational barrier about the 9,10 bond; however, both **1** and **2** exhibit sharp ^1H -nmr spectra. Since **1** and **2** have a 1,2-ene, while **3** bears a 1α -acetate, one would expect a larger 9,10 rotational barrier for **3**.

Consideration of the molecular formula of **2**, together with the formulas of established groups present, leads us to the conclusion that the C_6 side chain has the formula $\text{C}_6\text{H}_{11}\text{O}_3$. The ^1H -nmr spectrum is consistent with the assignment of this group in **2** as 3-methyl-2-hydroxypentanoate, the moiety also occurring at C-12 in **3**, a conclusion substantiated by COSY correlations between H-2' and H-3', H-3' with H_a-4', H_b-4' and 5'-Me, and H_a-4', H_b-4' with Me-6'. COSY correlations are also observed between H-9 and H-11, H-11 and H-12, H-1 and H-2, and H-17 and H-16. As reported for **3** (2), a small (0.6 Hz), long-range coupling is observed between H-11 and the formate proton. A NOESY experiment demonstrates correlations between H-29 and H-5, H-5 and H-9, and between H-9 and H-11, establishing the stereochemistry in this region to be the same as that reported for **3**. This experiment also demonstrates correlations between H-12 and H-17, H-22 with H-18, and H-22 with H-6', again establishing a stereochemical pattern as in **3**. A correlation is also observed between H-15 and H_b-30.

The C_6 moiety in **1** differs from that in **2** in having two fewer hydrogens, and the ^1H -nmr spectrum is consistent with its assignments as 3-methyl-2-oxopentanoate. This also accounts for a ^{13}C -nmr absorption at 196.6 ppm in **1** which is not present in the corresponding spectrum of **2**. Examination of the ^{13}C -nmr spectrum of a reference, ethyl 3-methyl-2-oxobutyrate, reveals its C-2 to absorb at 198 ppm. While the 3-methyl-2-hydroxypentanoate group is not uncommon in the limonoids, we are un-

aware of any report of 2-oxoester groups in this class of compounds. COSY and NOESY correlations establish the substitution and stereochemical relationships for **1** to be as described above for **2**. The presence of the 2' carbonyl in **1** led to substantial deshielding of the ^{13}C absorptions of C-18 and C-20 of **1** when compared to those of **2**. Also interesting is the lack of long-range coupling between C-11 and the formate proton in **1**, possibly reflecting a change in conformation in the absence of hydrogen bonding between the formate and the side chain at C-12.

APT and HETCOR methods were

TABLE 2. ^{13}C -nmr Data for Compounds **1** and **2**.

Carbon	Compound	
	1	2
C-1	147.4	147.5
C-2	122.7	122.7
C-3	173.2 ^a	173.6 ^a
C-4	83.5	83.6
C-5	50.3	50.4
C-6	34.7	34.7
C-8	140.1	136.1
C-9	53.0	53.2
C-10	45.9	45.4
C-11	76.3	69.9
C-12	70.1	75.2
C-13	45.4	45.9
C-14	70.8	70.7
C-15	59.6	59.6
C-16	33.8	33.8
C-17	37.9	37.7
C-18	24.3	15.2
C-19	24.3	23.7
C-20	135.9	121.6
C-21	140.3	140.5
C-22	111.0	111.0
C-23	142.8	142.8
C-28	63.8	63.7
C-29	24.6	24.5
C-30	121.7	121.8
C-11'	159.6	159.9
C-1'	160.8 ^a	165.5 ^a
C-2'	196.6	75.1
C-3'	43.4	37.8
C-4'	23.6	22.1
C-5'	13.5	13.5
C-6'	11.2	11.4
Me(OAc)	20.7	20.7
MeO	52.5	52.5
7-COOMe	165.4 ^a	170.4 ^a
OAc(CO)	170.5 ^a	173.3 ^a

^aValues in the same column are interchangeable.

utilized in assigning the carbon chemical shifts for **1** and **2** presented in Table 2.

EXPERIMENTAL

GENERAL EXPERIMENTAL METHODS.—Melting points were determined on a Fisher hot-stage apparatus and are uncorrected. ^1H - and ^{13}C -nmr spectra were obtained on a Varian XL-200 and a Varian XL-400 nmr spectrometer with TMS as internal standard and are reported downfield from TMS. Hrfab mass spectra were obtained on a JEOL JMS-SX102 by Dr. Robert Anderegg at Glaxo, Inc, Research Triangle Park, N.C.

PLANT MATERIAL.—The roots of *T. mombasana* were collected in May, 1989 from Shimba Hills, Kwale District, near Mombasa, Kenya. The plant was authenticated by S.G. Mathenge of the herbarium of the Department of Botany, University of Nairobi, and a reference specimen is on file in that department.

EXTRACTION AND CHROMATOGRAPHY.—The bark was removed from the root, air-dried 1 week, and ground into powder. The powder (100 g) was soaked in MeOH (2 liters) for 3 weeks at room temperature and filtered, and the extract was concentrated in vacuo, yielding 17 g of oil. A portion of the oil (13 g) was carefully chromatographed on a Si gel column (Merck Kieselgel 230–400 Mesh, 400 g). Elution with a hexane/EtOAc gradient (up to 75% EtOAc) afforded an oil (180 mg). Further purification of this oil on a Si gel column (30 g) eluted with EtOAc-toluene (4:6) followed by preparative tlc (Si gel) eluted with EtOAc-toluene (4:6) gave **1** and **2**.

Compound **1** (12.0 mg) was obtained as a white solid: mp 112–114°; hrfabms $[\text{M}]^+$ 684.2850 ($\text{C}_{36}\text{H}_{44}\text{O}_{13}$) (calcd 684.2769); ^1H nmr see Table 1; ^{13}C nmr see Table 2.

Compound **2** (20.8 mg) was obtained as a white solid: mp 116–118°, hrfabms $[\text{M}]^+$ 686.2912 ($\text{C}_{36}\text{H}_{46}\text{O}_{13}$) (calcd 686.2925); ^1H nmr see Table 1; ^{13}C nmr see Table 2.

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