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11,13-DIHYDROVERNOLIDE FROM THE FLOWER HEADS OF *VERNONIA AMYGDALINA* DEL.

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ABSTRACT

A crystalline sesquiterpene lactone $C_{19}H_{24}O_7$, mp. 187-88°C has been isolated from the flower heads of Vernonia amygdalina Del.(Asteraceae) for the first time. Intensive NMR spectral study and comparison with the data published on Vernonia lactones revealed that this compound is a lactone designated 11,13-dihydrovernolide. In addition, Vernolide, vernomygdin and vernodalin were isolated.

INTRODUCTION

Vernonia is a large genus (tribe Vernonieae, Asteraceae) originating in Africa and South America [1], with more than 1000 species. Due to the ascribed medicinal values of *Vernonia* species [2], plenty of phytochemical reports appeared in the literature [3-6] on the isolation of flavonoids, triterpenes, lipids, acetylenes in addition to the widely spread highly oxygenated sesquiterpene lactones.

In a publication about the chemistry of *Vernonia amygdalina* Del., Kupchan et al, reported the isolation of three biologically active sesquiterpene lactones from the aerial parts, named, vernolide, vernodalin, and vernomygdin [6]. These 3 lactones isolated from the chloroform extract showed a significant inhibitory activity *in-vitro* against cells derived from human carcinoma of the nasopharynx (KB) carried in tissue culture. So, it was thought promissing to isolate more of the active compounds of this plant.

EXPERIMENTAL

Plant Material:

The plant material used in this study was collected from plants cultivated in the Experimental Station of Medicinal Plants of the Dept. of Pharmacognosy, Faculty of Pharmacy, Assiut University. This plant has been introduced to Assiut from Sudan by one of the authors by careful cuttings cultivated in May 1982. The plant was identified by the courtesy of the kew garden in England.

Extraction and Isolation:

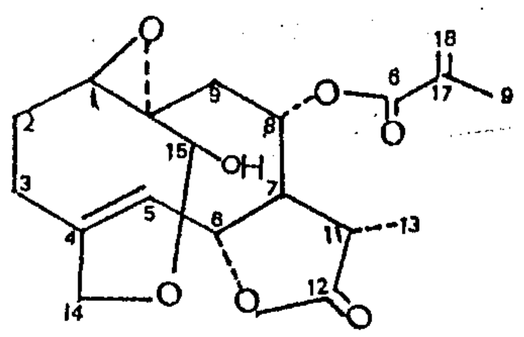
The fresh full grown flower-heads (700 gm) were extracted by maceration with hot alcohol 95% at room temp. for 2 days and the process of extraction was repeated twice. The resulting extract was evaporated under reduced pressure; the residue was dissolved in 70% alcohol and defatted with petroleum ether, then extracted with chloroform. The chloroform extract was condensed and the residue left (31 g.) was chromatographed on a column of silica gel (E.Merck, 1 kg) packed in chloroform. Elution was performed using gradient of chloroform-methanol collecting fractions, 150 ml each. Fractions were concentrated and monitored by TLC using silica gel G and chloroform-methanol (9:1). The developed chromatoplates were sprayed with 20% sulphuric acid and heated at 110°C for 10 min. Fractions of identical chromatographic pattern were pooled together, concentrated and left for crystallization.

Fractions (4-7) eluted with chloroform-methanol (98:2) showed a major spot. Repeated crystallization from acetone/pet. ether gave fine crystals (80 mg) designated compound A.

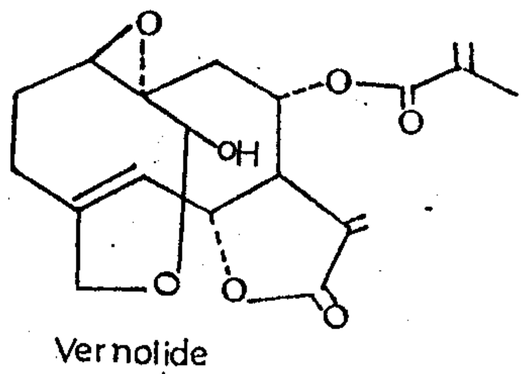
Fractions (11-28) eluted with chloroform-methanol (97:3) revealed the presence of two major spots. Trials for crystallization from different solvent mixtures failed to give crystalline deposits. The fractions were combined and rechromatographed on a column of silica gel packed in chloroform. The column was eluted with chloroform-acetone-methanol (90:10:1) to give two homogeneous crystalline fractions. Crystallization of the major one from acetone-pet. ether gave plates (60 mg) designated as compound B and crystallization of the minor fraction from acetone-pet. ether gave plates (40 mg) of compound C.

Fractions (30-35) eluted with chloroform-methanol (96:4) showed one major spot, a colourless oil which could not be crystallized and designated compound D.

Compound A, White creamy powder, recrystallized from acetone/pet. ether (1:1) as fine crystals, mp. 187-188°C: mass spectrum m/z 364(cal. for $C_{19}H_{24}O_7$), other characteristic peaks at 239, 276, 258, 230, 212, 69(100% $-CH_3-C-CO^+$) and 41. IR Kbr disc showed (OH) group at 3400, (δ lactone) at 1770 and ester at 1705 cm^{-1}. ^1H-NMR specturm Table 1.



A



Vernolide

Table 1: Comparative ^{1}H-NMR data for vernolide and dihydrovernolide.

Proton	Vernolide δ ppm		Dihydrovernolide δ ppm.	
H-1	2.75	dd	2.71	dd
H-2	2.39	m	2.29	m
H-2`	1.55	m	1.67	dddd
H-3	2.40	m	2.40	m
H-5	5.58	d	5.50	d broad
H-6	5.20	dd	5.13	t
H-7	3.03	m	2.18	ddd
H-8	5.73	dd	5.66	ddd
H-9	2.67	d	2.64	d broad
H-9`	1.40	dd	1.32	dd broad
H-11	-		2.56	m
H-13	6.37	d	1.45	d (CH_3)
H-13`	5.95	d	-	
H-14	3.69	d	3.70	d
H-14`	4.60	d	4.58	d
H-15	4.56	d	4.59	d
OH	4.98	d	5.25	d
CH_3-19	1.97	s	1.97	s broad
H-18	6.15	s	6.15	d
H-18`	5.71	s	5.69	dq

Vernolide: J(Hz): 7,13=7; 7,13`=2.5; 8,9=10.5; 8,7=8; 5,6=10; 6,7=9; 14,14`=13; 1,2`=12; 1,2=4.5; 9,9`=15; 8,9`=10.5.

Dihydrovernolide: J(Hz): 1,2=4; 1,2`=11, 2,2`=13; 2`,3=7; 2`,3`=11; 5,6=10; 5,15=1.3; 7,8=9; 7,11=11; 8,9`=10; 9,9`=14; 11,13=7.

RESULTS AND DISCUSSION

The structure of the isolated compound A. was deduced by comparison of its NMR spectrum with that of vernolide (Table 1). The changed nature of the C_{13} methylene group in vernolide resulted in the disappearance of the two doublets at δ 5.95 and δ 6.37 characteristic for the H_{13} and the appearance instead of a 3 protons doublet at δ 1.45. This was confirmed from spectral data which showed m/z 364, a value which is 2 mass units more than that of vernolide.

Compound B, obtained in the form of white plates mp. 180-183°C and identified as vernolide based on the comparison of the physical and spectral data with those in the literature [8].

Compound C, occurs as plates mp. 208-210°C which was identified as vernomygdin. The physical and spectral data was identical with those in the literature [6].

Compound D, occurs as oily material which was identified as vernodalin by comparison of its physical and spectral data with those in the literature [6].

From the above mentioned data and comparison with the compounds isolated from *Vernonia* species, we conclude that compound (A) is 11,13-dihydrovernolide isolated for the first time from *Vernonia amygdalina* Del. This compound was previously isolated as an oil from *Vernonia condensata* [9].

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١١-١٣ داى هيدروفرنوليد من الفرنونيا

اميجد البنا

نصر أحمد العمرى - أحمد عابدين عطية

قسم العقاقير - كلية الصيدلة - جامعة اسيوط

قام الباحثان باستخلاص المسحوق المجفف لقمم أزهار نبات الفرنونيا اميجد البنا بالبترول الايثيرى ثم بالكلوروفورم وقد تم فصل أربعة مركبات من خلاصة الكلوروفورم وتم التعرف عليها عن طريق الصفات الطبيعية والطيفية "مثل الاشعة فوق البنفسجية - دون الحمراء - مطياف الكتلة والرنين النووى المغناطيسى".

كانت هذه المواد هى:.
١١-١٣ داى هيدروفرنوليد ، فرنوليد ، فرنومجدين ، فرنودالين.
والمركب الاول تم فصله لاول مرة من النبات محل الدراسة.

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