Short Communications

MONTANONE, A NEW SESQUITERPENE FROM *JASONIA MONTANA*

Ashraf A. El-Bassuony[1] and Amal M. Kabbash[2*]

أعطت الأجزاء الهوائية لنبات جاسونيا مونتانا *Jasonia montana* مركباً جديداً هو مونتانون وهو أحد مركبات أيزوإفيونان سيسكويتيربين. وتم التعرف على تركيب مركب مونتانون على أنه 11 ، 15- دايهيدروكسي إفيونان – 4- أون ، بواسطة تقنيات الطنين النووى المغناطيسى أحادى وثنائى الأبعاد بما فى ذلك HMQC و NOESY و HMBC.

The aerial parts of *Jasonia montana* afforded a new isoiphionane sesquiterpene, montanone **1.** The structure of **1** was elucidated to be 11,15-dihydroxy-iphionane-4-one by high field 1D and 2D NMR techniques, including HMQC, NOESY and HMBC.

Key word: *Jasonia Montana*, Asteraceae, sesquiterpenes, monanone.

Introduction

The genus *Jasonia* (=*Varthemia*), *Asteraceae*, tribe inuleae, subtribe inulinea, is a small genus with about five species mainly distributed in the Mediterranean region (1). Phytochemical studies on the different species of the genus lead to the isolation of volatile constituents (2), sesquiterpenes (3,4), monoterpenes (5), and flavonoids (6,7). Some species have antiprotozoal (8), antimicrobial (9), anti-inflammatory (3) and antidiabetic (10) activities.

The biological importance of members of this genus prompted us to investigate the aerial parts of *Jasonia montana,* (VahI) botsch. Previous work on *J. montana,* led to the isolation of geraniol derivatives (11), ilicic acid, costic acid derivatives, epimeric 5-hydroxy-β-eudesmols, eudesmanes and glucosides (5). Flavonoid aglycones (12), hydroxy jasionone (13), thymol derivatives, triterpenes, stigmasterol and sitosterol were also isolated (14). Two sesquiterpene glycosides with iphionane and isoiphionane skeletons were previously isolated from the aerial parts of *Iphiona scabra* (15). Our reinvestigation on the aerial parts of *Jasonia montana* afforded an isoiphionane sesquiterpene, named montanone **1**.

[1]Basic Science Department, Industrial Education College, Beni-Suef, Egypt.*[2] Pharmacognosy Department, Faculty of Pharmacy, Tanta, University, Tanta, Egypt.

*To whom correspondence should be addressed.

Experimental

Equipment:

1D and 2D spectra were recorded in chloroform-*d* at 300 MHZ on a Bruker Avance DRX-500 spectrometer using TMS as internal standard. Chemical shifts are reported in δ units. The gs-HMBC measurements were optimized at 7 Hz long-range couplings, whereas the NOESY experiments were run with 500 ms mixing time. MS measurements were recorded on Finnigan MAT 8430 and micromass VG-ZAB-E Instruments. The IR spectra (oily film, $CHCl_3$) were recorded on Perkin Elemer FT-IR-spectrometer. Optical rotations were measured with a JASCO-20C automatic recording spectropolarimeter. TLC development was performed on precoated silica gel sheets type 60 (Merck).

Plant material

The flowering aerial parts of *J. montana* (VahI) botsch. were collected on 22 July 2001 from the northern part of Sinai, Egypt. The plant was identified by Prof. Hany Awad, Department of Botany, Faculty of Science, El-Minia University . A voucher specimen (J. M. A. 20) is deposited at the Department of Botany, El-Minia University.

Extraction and separation:

The dry sliced aerial parts (800 g) of *J. montana* were powdered and extracted with methanol-

dichloromethane (1:1) (10 L) at room temperature, and the solvent was evaporated at 60 °C under reduced pressure to give 10 g of a dark yellow extract. This extract was fractionated by column chromtography on silica gel (silica gel 60, Merck, 1 Kg, 6×80 cm) using a step gradient of *n*-hexane-dichloromethane (100% hexane to 100% dichloro-methane). The dichloromethane (100 %) fraction (5 g) was purified on a Sephadex LH-20 column to give (15 mg, 0.3% yield) montanone **1**.

Montanone **1**: yellowish gummy material; $[\alpha]_D$ +27.0° (*c* 0.4, MeOH); IR (KBr film) ν_{max} 3450 cm^{-1} (OH), 1760 cm^{-1} (C=O); CIMS *m/z* (rel. int.) 255 $[M+H]^+$ (16), 237 $[(M+H)-H_2O-(CH-OH)]^+$ (100), 219 $[(M+H)-2H_2O]^+$(98), 207 $[(M+H)-H_2O-(CH-OH)]^+$(40), 201 $[(M+H)-3H_2O]^+$(25); HRCIMS *m/z* 255.19497 (calcd. for $C_{15}H_{27}O_3$ 255.19602); ^1H, ^{13}C NMR data see Table 1.

Table 1: ^1H and ^{13}C NMR spectral data of compounds **1** and **1a** ($CDCl_3$, 500 MHz).

Atom	I		I_a	
	δc (multiplicity)*	δ_H (*J* in Hz)	δc (multi-plicity)*	δ_H (*J* in Hz)
1	45.6 (t)	1.63 (m)	45.8	1.61
		1.55 (m)		1.56
2_{eq}	31.2 (t)	1.58 (m)	40.2	1.58
2_{ax}		2.43 (dt, *J* = 13.6)		1.59
3_{ax}	40.6 (t)	2.72 (t, *J* = 10.5)	40.4	2.64
3_{eq}		2.55 (m)		2.47
4	214.7 (s)		212.3	
5	65.5 (s)		62.9	
6	29.4 (t)	1.25 (m)	31.8	1.51
		1.24 (m)		1.50
7	49.8 (d)	1.52 (m)	50.2	1.53
8	24.8 (t)	0.97 (m)	22.8	1.15
		0.88 (m)		0.86
9	21.7 (t)	1.19 (m)	20.9	1.20
		1.20 (m)		1.25
10	43.5 (s)		43.7	
11	72.7 (s)		72.7	
12	27.9 (q)	1.24 (s)	26.3	1.24
13	26.3 (q)	1.19 (s)	24.9	1.20
14	22.2 (q)	1.15 (s)	22.1	1.19
15	66.5 (t)	4.02 (d, *J*= 10.5) 3.58 (d, *J*= 10.5)	68.1	4.46 4.10
OAc			171.2 (s)	
			28.1 (q)	2.00 (s)

* Multiplicity was determined by DEPT experiments.

Acetylation of **1:** Compound **1** (5 mg) was refluxed in 1 mL. of Ac_2O-C_5H_5N (1:1) for 2h. The mixture was worked up using separating funnel to separate organic phase (which contains acetylated compound) and aqueous phase at room temperature (25 °C) to give the monoacetate **1a** (3.5 mg, 0.25% yield). Colorless oil; IR (KBr film) ν_{max} 3450 cm^{-1} (OH), 1790 cm^{-1} (C=O); CI-MS *m/z* (rel. int.) 297 $[M+H]^+$ (10), 279 $[(M+H)-H_2O]^+$ (100), 261$[(M+H)-2H_2O]^+$ (10), 237 $[(M+H)-Ac-H_2O]^+$ (15), 219 $[(M+H)–Ac-2H_2O]^+$ (18), 201 $[(M+H)-Ac-3H_2O]^+$ (15); HRCIMS *m/z* 297.20549 (calc. for $C_{17}H_{29}O_4$ 297.20658); ^1H, ^{13}C- NMR data (Table 1).

Results and discussion

The CIMS of compound **1** showed a molecular ion peak $[M+1]^+$ at *m/z* 255 in accordance with the molecular formula $C_{15}H_{26}O_3$.

In the ^{13}C-NMR spectrum ($CDCl_3$, 125 MHz), the presence of a carbonyl function was supported by the resonance at δ_c 214.7. The DEPT experiment indicated four quaternary carbons at δ_c 214.7, 72.7, 65.5 and 43.5 (C-4, C-11, C-5 and C-10,) ; three methyl carbons at δ_c 27.9, 26.3 and 22.2 being typical for C-12, C-13 and C-14, respectively, seven methylene carbons at δ_c 45.6, 40.6, 31.2, 29.4, 24.8, 21.7 and 66.5 (C-1, C-3, C-2, C-6, C-8, C-9 and C-15,) and one methine carbon at δ_c 49.8 was C-7. The ^1H-NMR spectrum of **1** exhibited a different pattern compared to the previously reported sesquiterpenes in the genus *Jasonia*, where the spectrum showed two doublets at δ_H 4.02 (*J* = 10.5 Hz) and 3.58 (*J* = 10.5 Hz), correlated in HMQC with a carbon signal at δ_c 66.5 (H-15_a and H-15_b). Also, presence of three singlet signals at δ_H 1.24, 1.19 and 1.15, which were assigned for the three methyls H-12, H-13 and H-14, respectively. The protons and their positions could be assigned by ^1H-^1H COSY as following: the triplet signal at δ_H 2.72 (*J*= 10.5) was assigned for H-3_{ax} whereas H-3_{eq} proton appeared as multiplet signal at δ_H 2.55. The H-2 protons appeared as two signals at δ_H 1.58 (H-2_{eq}, m) and 2.43 (H-2_{ax}, dt, *J* = 13, 6). Additionally, the multiplet signal at δ_H 1.52 was assigned for H-7. From these data and from published data on similar compounds (14), it could be concluded that compound **1** could be a bicyclic sesquiterpene**.**

The structural determination of **1** could be accomplished using a combination of COSY and

HMBC. The HMBC correlation for substructures showed correlation between the carbonyl carbon at δ_c 214.7 (C-4) and H-3, H-6, H-15. Additionally, a correlation was observed between the tertiary carbon (δ_c 49.8, C-7) and H-$6_{a,b}$ and H-$8_{a,b}$. Two other correlations were detected between the carbonyl carbon at δ_c 214.7 (C-4) and the two methylene protons H-$3_{a,b}$ and H-$6_{a,b}$. Moreover the two correlation detected between methyl carbon at δ_c 22.2 (C-14) with the two methylene protons H-$1_{a,b}$ and H-$9_{a,b}$. The relative stereochemistry of **1** was deduced from the NOESY experiments (Fig. 1), which showed correlation between the methyl protons at δ_H 1.15 (H-14_β) with the two doublets at δ_H 4.02 (H-15_a) and 3.58 (H-15_b) and triplet signal at δ H 2.72 (H-3β). The correlation between the triplet signal at δ_H 2.72 (H-3_β) with the singlet signal at δ_H 1.24 (H-12) and singlet at δ_H 1.19 (H-13) suggested β-orientation of the methyl protons (H-12, H-13).

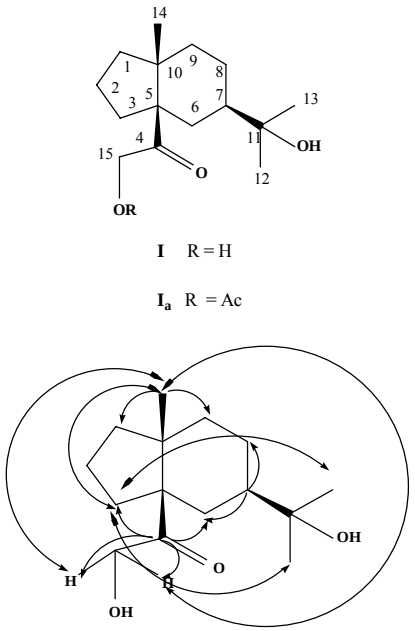

Fig. 1. HMBC and NOESY correlation of **1**

Single – headed arrows: indicate **HMBC** correlations of 1
Double – headed arrows: significant **NOESY** correlations

Acetylation of **1** afforded the monoacetate derivative **1a,** which had a peak at 279 $[M + H]^+$ and which confirmed the presence of two hydroxyl groups of which only one was reactive (the 1ry alcohol). Its 1D and 2D NMR spectra supported the proposed structure of **1**.

The ^{1}H-NMR of **1a** showed a new singlet signal at δ_H 2.00, characteristic for an acetyl group. This was confirmed by ^{13}C-NMR spectral data and DEPT experiments, which showed presence of two new carbon signals at δ_c 171.2 (C=O) and 28.1 (Me). The structure of **1a** was confirmed by HMBC. Therefore, compound **1** was assigned as 11,15-dihydroxy-iphionane-4-one, named montanone.

References

1. Bremer K, Anderberg AA, Karis PO, Nordenstam B, Lundberg J, Ryding O. *Asteraceae*, cladistics & classification. Timber Press, Portland, Oregon, 1994 : 287.
2. Romero MAG, Castillo LV, Lanza AMD, Bricio JMA, Monzon CAS, Perucha JS. Volatile composition of *Jasonia glutinosa*. Journal of Biosciences 2003; 58**:** 804-6.
3. Benito PB, Abad MJ, Diaz AM, Villaescusa L, Gonzalez MA, Silvan AM. Sesquiterpenes from *Jasonia glutinosa*. Biol Pharm Bull 2002; 25**,** 1-4.
4. Sanchez R, Villaescusa L, Bernabe M, Diaz AM. Two new eudesmane alcohols from *Jasonia glutinosa*. Journal of Biosciences 2000**;** 55**:** 693-6.
5. Ahmed AA, Jakupovic J. Sesqui-and monoterpenes from *Jasonia montana*. Phytochemistry 1990**;** 29: 3658-61.
6. Mossa JS, Hifnawy MS, Al-yahya MA, Hafez MM, Shehata AA, El-Feraly FS. Flavonoids and coumarins from three Saudi Arabian compositae species. International Journal of Crude Drug Research 1988; 26:,181-4.
7. Rubio B, Villaescusa L, Diaz AM, Fernandez L, Martin T. Flavonol glycosides from *Scolymus hispanicus* and *Jasonia glutinosa*. Planta Medica 1995; 61**:** 583-7.
8. Villaescusa L, Diaz A M, Gasquet M, Delmas F, Ollivier E, Bamabe M Faure R, Elias R, Balansard G. Antiprotozoal activity of sesquiterpenes from *Jasonia glutinosa*. Pharmaceutical biology (Lisse, Netherlands) 2000; 38: 176-80.
9. Hammerschmidt FJ, Clark AM, Soliman FM, El-Kashoury EA, Abd El-Kawy MM, El-Fishawy AM. Chemical composition and antimicrobial activity of essential oils of *Jasonia candicans* and *J. montana.* Planta Medica 1993; 59: 68-70.
10. Al-Howiriny TA, Al-Rehaily AJ, Polsc JR, Porter JR, Mossa JS, Ahmed B. Three new diterpenes and the biological activity of different extracts of *Jasonia montana*. Nat Prod Res. 2005 ;19:253-65.
11. Ahmed AA. Two geraniol derivatives from *Jasonia montana*. Pharmazie 1991; 46:362-3.
12. Ahmed AA, Ali AA, Mabry TJ. Flavonoid aglycones from *Jasonia montana*. Phytochemistry 1989; 28: 665-7.
13. Ahmed AA, Jakupovic J, Eid F, Ali AA. 11-Hydroxyjasionone, a new sesquiterpene type from *Jasonia montana*. Phytochemistry 1988; 27: 3875-7.
14. Eid F, El-Dahmy S, Gupta PK. Constituents from *Jasonia montana* and *Allagopappus dichotoma.* Pharmazie 1987; 42: 423-4.
15. El-Ghazouly MG, El-Sebakhy NA, Seif El-Din A A, Zdero C, Bohlmann F. Sesquiterpene Xylosides from *Iphiona Scabra*. Phytochemistry 1987; 26: 439-43.