Phytochemistry, Vol. 24, No. 6, pp. 1377–1378, 1985.
Printed in Great Britain.

0031–9422/85 \$3.00 + 0.00

SHORT REPORTS

A THYMOL DERIVATIVE FROM *INULA CRITHMOIDES*

MOHAMED ABBAS METWALLY and A. M. DAWIDAR

Institute for Organic Chemistry, Technical University of Berlin, D-1000 Berlin 12, West Germany

(*Received* 25 *March* 1984)

Key Word Index—*Inula crithmoides*; Compositae; 10-isovaleryloxy-8,9-epoxythymol-3-isovalerate.

Abstract—Re-investigation of the aerial parts and roots of *Inula crithmoides* afforded, in addition to known compounds, a new epoxythymol isovalerate. Its structure has been determined as 10-isovaleryloxy-8,9-epoxythymol-3-isovalerate.

INTRODUCTION

The genus *Inula* (Compositae, tribe Inuleae) is placed in the subtribe Inulinae [1]. About 25 species of this large genus have already been investigated chemically. Most widespread are eudesmanolides [2–6], but other types of sesquiterpene lactones have also been isolated [2, 6]. We have now re-investigated the aerial parts and roots of *Inula crithmoides* L.

RESULTS AND DISCUSSION

From the aerial parts of *I. crithmoides*, collected in March 1983 at Mallorca Island, a number of known compounds, abienol, two thiophene acetylenes [7], five thymol derivatives [8–10] and three 8,9-epoxythymol esters [11–13], stigmasterol and a new isovalerate 8,9-epoxythymol derivative **1** were isolated.

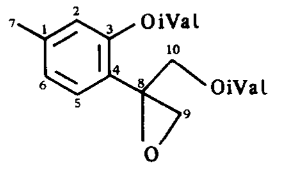
The structure of the isovalerate derivative **1** clearly followed from the ^{1}H NMR spectral data (Table 1). The presence of 3-isovalerate was obvious from the signals (2.45 *d*, 2.47 *d*, 2.23 *ddqq* and 1.05 *br d*). The 10-isovalerate could also be deduced from the signals (2.14 *d*, 2.33 *d*, 2.02 *ddqq* and 0.88 *d*). The other oxygen functions were assigned to an epoxide group. The signals of H-9 and H-10 were nearly the same as those of similar compounds and the chemical shifts of the aromatic proton signals also agreed with the substitution pattern proposed.

The roots afforded thiophene acetylenes [7], two thymol derivatives [8–10], thymol epoxides [11–13] and stigmasterol, in addition to the new isovalerate **1**. The eudesmanolide isolated previously from an Egyptian collection [6] was not observed.

EXPERIMENTAL

^{1}H NMR: 400 MHz, TMS as internal standard; MS: 70 eV, direct inlet. The air-dried plant material, collected in March 1983 at Mallorca Island was extracted with Et_2O–petrol–MeOH (1:3:1). The extract of the aerial parts (211 g) was first treated with MeOH to remove long-chain hydrocarbons and was then partially separated by CC (SiO_2) with petrol and increasing amounts of Et_2O and finally Et_2O–MeOH (10:1). The fraction obtained with 10% Et_2O afforded 10 mg abienol. The fraction obtained with petrol and separated further by TLC (petrol) afforded seven known compounds. The fraction obtained with 25% Et_2O was separated further by TLC (10% Et_2O) to afford 2 mg **1** and 3 mg abienol. The fraction obtained with 50% Et_2O was further separated by TLC (25% Et_2O) to give 2 mg each of three known epoxythymols and 2 mg stigmasterol.

Similarly, the root extract (111 g) was defatted and separated by CC (SiO_2) with petrol and increasing amounts of Et_2O and



1

Table 1. ^{1}H NMR spectral data of compound **1** (400 MHz, $CDCl_3$, TMS as internal standard)

H-2	6.85 *s br*	
H-5	7.35 *d*	(8)
H-6	7.04 *d br*	
H-7	2.34 *s*	
H-9	3.02 *d*	(5.5)
H-9′	2.79 *dd*	
H-10	4.57 *d*	(12)
H-10′	4.26 *d*	
3-*i*-Val	2.45 *d*	(6)
	2.47 *d*	(6)
	2.23 *ddqq*	(7)
	1.05 *d br*	(7)
10-*i*-Val	2.14 *d*	(6)
	2.33 *d*	(6)
	2.02 *ddqq*	(7)
	0.88 *d*	(7)

Coupling constants (*J*, in Hz) are given in parentheses.

finally Et_2O–MeOH (10:1). The fraction obtained with petrol was separated further by TLC (petrol) to afford 1 mg acetylenes [7] and 1 mg thymol derivatives [8–10]. The fraction obtained with 10% Et_2O was separated further by TLC (50% Et_2O) to afford 2 mg **1** and 2 mg abienol. The fraction obtained with 50% Et_2O was separated further by TLC (50% Et_2O) to give 1.5 mg of a known epoxythymol.

10-Isovaleryloxy-8,9-epoxythymol-3-isovalerate (**1**). Colourless oil, IR $\nu_{\max}^{CCl_4}$ cm^{-1}: 1760, 1745 (CO_2R); MS *m/z* (rel. int.): 348.194 $[M]^+$ (1.2) ($C_{20}H_{28}O_5$), 246 $[M - C_4H_9COOH]^+$ (6.8), 145 $[246 - \text{isovalerate}]^+$ (23), 85 $[C_5H_9O]^+$ (57), 57 $[85 - CO]^+$ (100).

Acknowledgements—I am grateful to Professor Dr. F. Bohlmann, Technical University of Berlin, for the plant material and spectral measurements and A.v.H.-Stiftung for financial support.

REFERENCES

1. Merxmüller, H., Leins, P. and Roessler, H. (1977) in *The Biology and Chemistry of the Compositae* (Heywood, V. H., Harborne, J. B. and Turner, B. L., eds.). Academic Press, London.
2. Bohlmann, F., Mahanta, P. K., Jakupovic, J., Rastogi, R. C. and Natu, A. A. (1978) *Phytochemistry* **17**, 1165.
3. Qurishi, M. A., Dhar, K. L. and At, C. K. (1980) *Planta Med.* **38**, 282.
4. Evan, F. J. and Schmidt, R. J. (1980) *Planta Med.* **38**, 289.
5. Papanov, G. Y., Malakov, P. Y. and Bohlmann, F. (1980) *Phytochemistry* **19**, 152.
6. Mahmoud, Z. F., Abdel Salam, N. A., Sarg, T. M. and Bohlmann, F. (1981) *Phytochemistry* **20**, 735.
7. Bohlmann, F., Burkhardt, T. and Zdero, C. (1973) *Naturally Occurring Acetylenes*. Academic Press, London.
8. McPhail, A. T. and Onan, K. D. (1975) *J. Chem. Soc. Perkin Trans.* 2, 1798.
9. Bohlmann, F., Mahanta, P. K., Suwita, A., Suwita, Ant., Natu, A. A., Zdero, C., Dorner, W., Ehlers, D. and Grenz, M. (1977). *Phytochemistry* **16**, 1973.
10. Bohlmann, F. and Zdero, C. (1982). *Phytochemistry* **21**, 139.
11. Bohlmann, F. and Suwita, A. (1978). *Phytochemistry* **17**, 1929.
12. Bohlmann, F. and Zdero, C. (1977). *Phytochemistry* **16**, 1773.
13. Bohlmann, F., Singh, P., Jakupovic, J., Robinson, H. and King, R. M. (1982) *Phytochemistry* **21**, 705.

Phytochemistry, Vol. 24, No. 6, pp. 1378–1380, 1985.
Printed in Great Britain.

0031–9422/85 $3.00 + 0.00

SECO-HELENANOLIDES FROM *DUGALDIA INTEGRIFOLIA*

FERDINAND BOHLMANN, LAXMI N. MISRA and JASMIN JAKUPOVIC

Institute for Organic Chemistry, Technical University of Berlin, D-1000 Berlin 12, West Germany

(*Received* 10 *August* 1984)

Key Word Index—*Dugaldia integrifolia*; Compositae; sesquiterpenes; *seco*-helenanolides; 13-isobutyryloxysilphinen-3-one.

Abstract—The aerial parts of *Dugaldia integrifolia* afforded, in addition to acetylhymenograndin, floribundin, hymenoxon and isotelekin, three new *seco*-helenanolides and two derivatives of silphinene, one being isolated previously from *Dugaldia hoopesii*.

Dugaldia integrifolia (H.B.K.) Cass. [= *Helenium integrifolium* (H.B.K.) Benth. + Hook.] has been investigated previously [1]. In addition to a flavone, two pseudoguaianolides were isolated. Re-investigation of the aerial parts gave in addition to widespread compounds, acetylhymenograndin [2], isotelekin [3], floribundin [4] and hymenoxon [5, 6] isolated as its diacetate **8**, and three further sesquiterpene lactones, the *seco*-helenanolides **5**–**7**. Furthermore, the thymol derivatives **3** and **4**, 3-oxosilphinene (**1**) [7] and the isobutyryloxy derivative **2** were present. The mass spectrum of **2** gave the molecular formula $C_{19}H_{28}O_3$, and a strong fragment at *m/z* 216 agreed with the elimination of the acid part. The structure of the ester could be deduced from the ^1H NMR spectral data (see Experimental) which were close to those of **1** [7]. However, one of the methyl singlets was replaced by a pair of doublets at δ3.63 and 3.49 and, furthermore, the characteristic signals of an isobutyryloxy group were present. The observed shift differences of H-5, H-7 and H-11 in the spectra of **1** and **2** allowed the assignment of the position of the ester group. Furthermore, the *W*-coupling between H-13 and H-5α was missing, which was present in the spectrum of **1**.

The structures of **5**–**7** also followed from the ^1H NMR spectral data (Table 1). All signals could be assigned by spin decoupling. The partial structures obtained in this way clearly showed that *seco*-helenanolides were present, differing only in the nature of the oxygen function, which