Phytochemistry, Vol. 23, No. 12, pp. 2953–2954, 1984.
Printed in Great Britain.

0031-9422/84 \$3.00 + 0.00

SESQUITERPENE LACTONES FROM *CHRYSANTHEMUM CORONARIUM*

SAWSAN EL-MASRY, AMINA H. A. ABOU-DONIA, FIKRIA A. DARWISH, MOHAMED A. ABOU-KARAM, MICHAEL GRENZ* and FERDINAND BOHLMANN*

Department of Pharmacognosy, Faculty of Pharmacy, University of Alexandria, Egypt; *Institute for Organic Chemistry, Technical University of Berlin, D-1000 Berlin 12, West Germany

(*Received* 13 *March* 1984)

Key Word Index—*Chrysanthemum coronarium*; Compositae; sesquiterpene lactones; guaianolides; cumambrin A; new dihydrocumambrin A.

Abstract—The flower heads of *Chrysanthemum coronarium* afforded a new sesquiterpene lactone, dihydrocumambrin A, in addition to the known cumambrin A.

INTRODUCTION

It has been reported that *Chrysanthemum* species contain sesquiterpene lactones [1–4], acetylenes [5], coumarins [6] and flavonoids [7, 8]. The genus *Chrysanthemum* is represented in Egypt by only one species, *C. coronarium* [9]. A lyratol ester has been isolated from this species [10].

This paper reports the isolation from the flower heads of *C. coronarium* L., of a new guaianolide lactone, dihydrocumambrin A, together with the previously known sesquiterpene lactone cumambrin A (**1**). The identity of the latter [11] was confirmed by comparison of its spectral data (NMR, MS and IR) with those of authentic material.

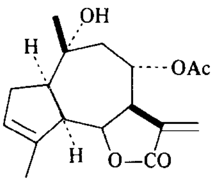
RESULTS AND DISCUSSION

Dihydrocumambrin A (**2**) forms colourless crystals, mp 174°. From the accurate mass spectral measurements, the molecular ion at m/z 308.162 is in agreement with the molecular formula $C_{17}H_{24}O_5$ (calculated 308.162). The mass spectral data indicate that **2** contains an acetoxy function (m/z 248 $[M - HOAc]$) and a hydroxyl group (m/z 230 $[M - HOAc - H_2O]^+$), the presence of which are confirmed by the IR bands at 1740 (OAc) and 3600 cm^{-1} (hydroxyl). The presence of a γ-lactone moiety is shown by an IR band at 1775 cm^{-1}. In the ^1H NMR spectrum (Table 1), which is similar to that of **1**, the following signals attributable to methyl groups are observed: a singlet at δ2.11 for an acetoxy methyl; a singlet at δ1.22 for the C-10 methyl; a doublet at δ1.26 for the C-11 methyl; a broadened singlet at δ1.86 for the C-4 methyl. In addition, the downfield shift of the H-3 proton signal at δ5.48 indicates the methyl group at C-4. The dihydro nature of cumambrin A was indicated by the methyl doublet at δ1.26 (C-13 Me) together with the doublet quartet at δ2.41 (H-11). The configuration at C-11 followed from the coupling $J_{7,11}$.

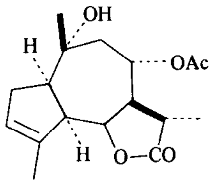
EXPERIMENTAL

C. coronarium was collected early in March 1983 from Borg El-Arab, 50 km west of Alexandria. The plant was authenticated by Prof. Loutfy Bolous (National Research Centre, Cairo, Egypt). A voucher specimen has been deposited at the Department of Pharmacognosy, Faculty of Pharmacy, University of Alexandria.

The fresh flowers (3 kg) were minced and extracted with petrol–Et_2O (2:3). The conc. extract precipitated a green deposit, which was filtered through glass wool. On keeping the filtrate, a yellow deposit (flavonoids) was separated and the filtrate was concd to dryness to give 15 g of residue. The latter was fractionated by CC on silica gel with petrol–$CHCl_3$ mixtures. The fractions eluted with $CHCl_3$–petrol (4:1) were found to have a bitter taste and showed one major spot (R_f 0.6) by TLC on silica



1



2

Table 1. ^1H NMR spectral data of dihydrocumambrin A (400 MHz, $CDCl_3$, TMS as internal standard)

H	δ	H	δ
1	2.57 *ddd*	8	5.13 *ddd*
2	2.26 *dd* (*br*)	9	2.30 *dd*
2'	2.17 *dd* (*br*)	9'	1.76 *ddd*
		11	2.41 *dq*
3	5.48 *s* (*br*)	13	1.26 *d*
5	2.73 *dd* (*br*)	14	1.22 *s*
6	4.02 *dd*	15	1.86 *dt*
7	2.82 *ddd*	OAc	2.11 *s*

J (Hz): 1, 2 = 1, 2' = 1, 5 = 9; 2, 2' = 0.5; 1, 2 = 1, 2' = 8; 5, 6 = 6, 7 = 7, 8 = 10; 7, 11 = 11; 8,9 = 6; 8, 9' = 3.5; 9, 9' = 16; 9', 14 ~ 0.5; 3, 15 = 2, 15 ~ 1.5.

All signals were assigned by spin decoupling.

gel ($CHCl_3$–MeOH, 9:1). Prep. TLC afforded 30 mg of a mixture of cumambrin A and the new dihydrocumambrin A; the two compounds were separated from each other by HPLC (RP8, MeOH–H_2O (3:2), flow rate 3 ml/min, ca. 100 bar).

Dihydrocumambrin A. Colourless crystals, mp 174°; IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3600 (OH), 1775 (γ-lactone) and 1740 (OAc); MS m/z (rel. int.): 308.162 $[M]^+$ (2) (calc. for $C_{17}H_{24}O_5$, 308.162), 290 $[M-H_2O]^+$ (6.5), 248 $[M^+ - HOAc]^+$ (11), 230 $[M-HOAc-H_2O]^+$ (37), 167 (82), 107 (77), 91 (95) and 81 (100).

$$[\alpha]^{\lambda}_{24^\circ} = \frac{589 \quad 578 \quad 540 \quad 436\ \text{nm}}{+44 \quad +46 \quad +49 \quad +73}\ (\mathrm{CHCl_3};\ c\ 0.08).$$

REFERENCES

1. Haruna, M., Kato, M., Ito, K., Nikai, T., Sugihara, H. and Murata, H. (1981) *Phytochemistry* **20**, 2583.
2. Bloszysk, E., Geppert, B. and Drozdz, B. (1978) *Planta Med.* **34**, 79.
3. Bloszysk, E., Drozdz, B. (1978) *Acta Soc. Bot. Pol.* **47**, 3.
4. Drozdz, B. and Bloszysk, E. (1978) *Planta Med.* **33**, 379.
5. Wrang, P. A. and Jorgen, L. (1975) *Phytochemistry* **14**, 1027.
6. Öksüz, S. and Wagner, H. (1982) *J. Nat. Prod.* **45**, 374.
7. Harborne, J. B., Heywood, V. H. and Saleh, N. A. M. (1970) *Phytochemistry* **9**, 2011.
8. Chatterjee, A., Sarkar, S. and Saha, S. K. (1981) *Phytochemistry* **20**, 1760.
9. Tackholm, V. (1974) *Student's Flora of Egypt*, p. 578. Cairo University Press, Cairo.
10. Bohlmann, F. and Fritz, U. (1979) *Phytochemistry* **18**, 1888.
11. Romo, J., Romo de Vivar, A. and Díaz, E. (1968) *Tetrahedron* **24**, 5625.

Phytochemistry, Vol. 23, No. 12, pp. 2954–2956, 1984.
Printed in Great Britain.

0031-9422/84 \$3.00 + 0.00

SESQUITERPENE LACTONES FROM A FURTHER POPULATION OF *ARTEMISIA HERBA ALBA*

R. SEGAL,* L. EDEN,* A. DANIN,† M. KAISER‡ and H. DUDDECK‡

*Department of Natural Products, The Hebrew University of Jerusalem, Israel; †Department of Botany, The Hebrew University of Jerusalem, Jerusalem, Israel; ‡Lehrstuhl für Strukturchemie, Abteilung für Chemie, Ruhr-Universität Bochum, West Germany

(*Revised received* 12 *June* 1984)

Key Word Index—*Artemisia herba alba*; Compositae; herbolides E and F; germacranolide; eudesmanolide.

Abstract—Two new sesquiterpene lactones, herbolides E and F, have been isolated from a further chemotype of *Artemisia herba alba*.

The sesquiterpene lactone constitution of five different populations of *Artemisia herba alba* growing in the Middle East has recently been reported [1–6]. Because of the extensive use of this herb in folk medicine [7, 8], the elucidation of various chemotypes is of great interest. We wish to report now the existence of a further chemotype of *Artemisia herba alba* growing in the Judean desert of Israel, based upon the constitution of its sesquiterpene lactones.

The dichloromethane extract of the inflorescences, small stems and leaves yielded on column chromatography (CC) only two fractions of sesquiterpene lactones, from which herbolide E (**1**) and herbolide F (**2**) were isolated. The structure elucidation of the two novel herbolides was based on extensive use of spectroscopic methods.

Herbolide E, which emerged first on CC, has an empirical formula of $C_{15}H_{22}O_4$, which was established by high-resolution mass spectrometry (HRMS). In its IR spectrum herbolide E showed bands for a hydroxyl function (3400 cm^{-1}) and a γ-lactone group (1760 cm^{-1}). No further carbonyl band, for example for an acetate, was observed. The eudesmanolide structure with two hydroxyl substituents was assigned to herbolide E on the basis of the following data. The 300 MHz ^1H NMR spectrum showed a three-proton singlet at δ1.19 (Me-14), indicating an angular position of the methyl group. The signal of a second methyl group appeared as a narrow doublet at δ2.00 ($J = 1.3$ Hz, Me-15). The presence of a Δ^4-double bond was deduced from the appearance of the H-6 proton signal as a doublet at δ4.82 ($J = 11.5$ Hz). Irradiation at the H-7 multiplet (δ2.25) turned this doublet into a singlet. One hydroxyl group was assigned to the 9β-position because of the chemical shift of the H-9 signal (δ3.83) and the similarity of its shape compared with the corresponding H-9 signals in other herbolides [2, 6] and their eudesmanolide derivatives [9]; the total coupling constants of 16 Hz suggested an antiperiplanar orientation of H-9 and H-8β. The other hydroxyl must be in the 3α-position because of its appearance as a narrow multiplet at δ4.02 ($\Delta\nu_{1/2} \approx 8$ Hz) which apparently does not contain an antiperiplanar hydrogen–hydrogen three-