Phytochemistry, Vol. 21, No. 8, pp. 2119–2120, 1982.
Printed in Great Britain.

0031-9422/82/082119-02$03.00/0

A GUAIAN-5, 12-OLIDE FROM *HYPOCHOERIS CRETENSIS**

FERDINAND BOHLMANN and PAHUP SINGH

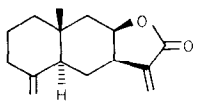
Institute for Organic Chemistry, Technical University of Berlin, D-1000 Berlin 12, West Germany

(*Received* 20 *October* 1981)

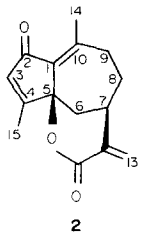
Key Word Index—*Hypochoeris cretensis*; Compositae; sesquiterpenes; guaianolide; 5, 12-lactone.

Abstract—*Hypochoeris cretensis* afforded, in addition to triterpenes and isoalantolactone, a new guaian-5, 12-olide and the corresponding precursor.

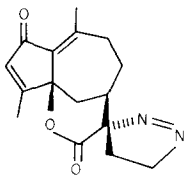
So far the investigations of representatives of the genus *Hypochoeris* have shown that guaianolides related to lactucin may be characteristic for this genus [1–3]. We have now studied the constituents of *H. cretensis* Benth. The roots contained taraxasterol, lupeol and its acetate together with its Δ 12-isomer, while the aerial parts also afforded the same triterpenes as well as phytol and isoalantolactone (**1**). Furthermore, minute amounts of two closely related sesquiterpenes were isolated, the lactone **2** and the ester **4**. The structure of **2**, which on addition of diazomethane afforded the pyrazoline **3**, was deduced from the molecular formula and the highfield ^{1}H NMR spectrum (Table 1). The presence of a methylene lactone followed from the typical pair of downfield signals at δ 6.62 and 5.71. The IR band at 1740 cm^{-1} indicated a δ-lactone. The chemical shifts of two olefinic methyls and a quartet at δ 6.18 showed that most likely a guaianolide with a keto group at C-2 and a 1(10) as well as a 3, 4-double bond were present. The absence of a H-5 signal and the results of spin decoupling clearly showed that a 5, 12-guaianolide was present, which required an equatorial orientation of H-7. Accordingly, this signal was narrowly split only as all couplings were small. Inspection of a model further showed that the angles H-7–H-13 supported the observed small couplings of H-13. The stereochemistry of the pyrazoline derivative **3** followed from the observed downfield shift of H-6β (Table 1). The ^{1}H NMR spectral data of **4** (Table 1) showed that a methyl ester was present. The conformation was clearly different from that of **2** since H-7 was now axial as followed from the coup-



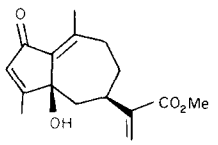
1



2



3



4

Table 1. ^{1}H NMR spectral data of compounds **2–4** (400 MHz, $CDCl_3$, TMS as int. standard)

	2	3	4 $CDCl_3$–C_6D_6, 1:1
H-3	6.18 *q*	6.23 *q*	5.77 *q*
H−6α	1.88 *dd*	1.97 *dd*	1.80 *d*
H-6β	2.36 *dd*	3.65 *ddd*	
H-7α	3.20 *s br*	2.30 *m*	2.63 *dd br*
H-8α	1.66 *m*	1.91 *m*	2.15 *ddd*
H-8β	1.93 *ddd*	2.01 *m*	1.51 *ddd*
H-9α	2.08 *ddd*	2.19 *ddd*	2.67 *ddd*
H-9β	2.75 *ddd br*	2.70 *ddd br*	2.05 *ddd*
H-13	6.62 *d*	2.48 *ddd*	6.08 *s br*
H-13′	5.71 *s br*	2.36 *m*	5.40 *s br*
H-14	2.40 *s*	2.40 *s*	2.24 *s*
H-15	2.06 *d*	2.20 *d*	1.75 *d*
H-16	—	5.04 *ddd*	—
H-16′	—	4.78 *ddd*	—
OMe	—	—	3.71 *s*

J (Hz): compound **2**: 3, 15 = 1.5; 6α, 6β = 13.5; 6α, 7 = 2.5; 6β, 7 = 3; 7, 8α ~ 3; 7, 8β = 3; 7, 13 = 1.3; 8α, 8β = 13; 8α, 9α = 5; 8α, 9β = 12; 8β, 9α = 2; 8β, 9β = 3; 9α, 9β = 15; compound **3**: 3, 15 = 1.5; 6α, 6β = 14; 6α, 7 = 2.5; 6β, 7 = 4; 6β, 8α = 1; 8α, 9α = 5; 8β, 9α = 2; 8β, 9β = 3; 9α, 9β = 15; 13, 13′ = 12.5; 13, 16 = 2.5; 13, 16′ = 8.5; 13′, 16 = 10; 13′, 16′ = 8.5; 16, 16′ = 18; compound **4**: 3, 15 = 1.5; 6, 7 = 8; 7, 8α = 6; 7, 8β = 6; 8α, 8β = 15; 8α, 9α = 8α, 9β = 8β, 9α = 8β, 9β = 6.5; 9α, 9β = 16.

*Part 432 in the series "Naturally Occurring Terpene Derivatives". For Part 431, see Bohlmann, F., Borthakur, N., King, R. M. and Robinson, H. (1982) *Phytochemistry* **21**, 1793.

lings observed. Spin decoupling allowed the assignment of all signals. **4** we have named methyl hypocretenoate and **2** hypocretenolide. Though **2** and **4** have somewhat unusual structures, their close relationship to lactucin-like lactones is obvious.

EXPERIMENTAL

The fresh plant material (grown from the seeds from the Botanical Garden, Dijon, voucher 81/1510, deposited in the Institute of Organic Chemistry, Berlin) was extracted with Et_2O–petrol, 1:2, and the resulting extracts were separated by CC (Si gel) and repeated TLC (Si gel). Known compounds were identified by comparing the ^1H NMR spectra with those of authentic material. The roots (50 g) gave 10 mg taraxasterol, 2 mg lupeol and 20 mg of its acetate together with its Δ 12-isomer, while the aerial parts (250 g) afforded 10 mg taraxasterol, 200 mg lupeol, 100 mg lupeyl acetate and its Δ 12-isomer, 10 mg phytol, 21 mg **1**, 1 mg **2** (Et_2O-petrol, 3:1) and 2 mg **4** (Et_2O–petrol, 3:1).

Hypocretenolide (**2**). Colourless gum, IR $\nu_{max}^{CCl_4}$, cm^{-1}: 1740 (δ-lactone), 1710 (C=CC=O); MS *m/z* (rel. int.): (CI, isobutane): 245 $[M+1]^+$ (100) ($C_{15}H_{16}O_3+1$), 217 $[245-CO]^+$ (5), 201 $[245-CO_2]^+$ (5).

To 1 mg **2** in 0.5 ml Et_2O excess of CH_2N_2 in Et_2O was added. After 5 min evaporation afforded 1 mg **3**, colourless solid, MS *m/z* (rel. int.): 258.126 $[M-N_2]^+$ (100) ($C_{16}H_{18}O_3$), 230 $[258-CO]^+$ (3), 215 $[230-Me]^+$ (2);

$$[\alpha]_{24°}^{\lambda} = \frac{589 \quad 578 \quad 546 \quad 426\ nm}{-30 \quad -30 \quad -40 \quad -100} \quad (c = 0.08, CHCl_3).$$

Methyl hypocretenoate (**4**). Colourless gum, IR $\nu_{max}^{CCl_4}$, cm^{-1}: 3400 (OH), 1725 (CO_2R), 1710, 1630 (C=CC=O); MS *m/z* (rel. int.): 276.136 $[M]^+$ (10), ($C_{16}H_{20}O_4$), 258 $[M-H_2O]^+$ (100), 226 $[258-MeOH]^+$ (25), 211 $[226-Me]^+$ (14);

$$[\alpha]_{24°}^{\lambda} = \frac{589 \quad 578 \quad 546 \quad 436\ nm}{+35 \quad +41 \quad +42 \quad +53} \quad (c = 0.1, CHCl_3).$$

Acknowledgement—We thank the Deutsche Forschungsgemeinschaft for financial support.

REFERENCES

1. Gonzales, A., Bermejo, J., Massanet, G. M., Amaro, J. H. and Dominguez, B. (1976) *Phytochemistry* **15**, 991.
2. Bohlmann, F. and Bohlmann, R. (1980) *Phytochemistry* **19**, 2045.
3. Bohlmann, F., Jakupovic, J., Abraham, W.-R. and Zdero, C. (1981) *Phytochemistry* **20**, 2371.

Phytochemistry, Vol. 21, No. 8, pp. 2120–2122, 1982.
Printed in Great Britain.

0031-9422/82/082120-03$03.00/0

GUAIANOLIDES FROM *AINSLIAEA FRAGRANS**

FERDINAND BOHLMANN and ZHONG-LIANG CHEN†

Institute for Organic Chemistry, Technical University of Berlin, D-1000 Berlin 12, West Germany;
†Institute of Materia Medica, Chinese Academy of Sciences, Yuyang Road 319, Shanghai, China

(*Received* 16 *October* 1981)

Key Word Index—*Ainsliaea fragrans*; Compositae; sesquiterpene lactones; guaianolides.

Abstract—Five sesquiterpene lactones were isolated from *Ainsliaea fragrans*, two of them being new.

The medicinal plant *Ainsliaea fragrans* Champ. (tribe Mutisieae) has long been used in north China for arresting haemorrhages, curing wounds and dispersing blood clots [1]. The chemistry so far has not been investigated. We have now isolated five guaianolides all being 6, 12-*trans*-lactones, two of them being new.

The aerial parts of *A. fragrans* afforded stigmasterol, caryophyllene, zaluzanin C (**1**) [2], 8-α-hydroxy-11α, 13-dihydrozaluzanin C (**2**), 11α, 13-dihydrozaluzanin C (**5**) and a mixture of 4β, 14-dihydrozaluzanin C (**7**) and 4β, 14, 11α, 13-tetrahydrozaluzanin C (**8**). The structure of **2** was deduced by detailed examination of its expanded 400 MHz ^1H NMR spectrum (Table 1) and from spin decoupling experiments. Acetylation of **2** yielded the acetates **3** and **4**. Careful spin decoupling of the diacetate **4** allowed the assignment of all signals. Irradiation of the H-3α signal at δ 5.54 col-

*Part 426 in the series "Naturally Occurring Terpene Derivatives". For Part 425, see Bohlmann, F., Jakupovic, J. and Ahmed, M. (1982) *Phytochemistry* **21**, 2027.