

## A GUAIANOLIDE FROM *MAGNOLIA GRANDIFLORA*

AHMED F. HALIM, EL-SAYED S. MANSOUR, FARID A. BADRIA, JÜRGEN ZIESCHE\* and FERDINAND BOHLMANN\*

Faculty of Pharmacy, Mansoura University, Mansoura, Egypt; \*Institute for Organic Chemistry, Technical University of Berlin, D-2000 Berlin 12, West Germany

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**Key Word Index**—*Magnolia grandiflora*; Magnoliaceae; sesquiterpene lactones; guaianolide.

**Abstract**—The leaves of *Magnolia grandiflora* afforded in addition to costunolide diepoxide and parthenolide a guaianolide named magnograndiolide.

The germacranolide lactones parthenolide (**1**), costunolide, costunolide diepoxide, peroxycostunolide (verlotrin) and peroxyparthenolide have been isolated from the leaves of *Magnolia grandiflora* L. growing in the U.S.A. [1–4]. The alcohol extract of the same species growing in Egypt, afforded in addition to **1** and costunolide diepoxide, the dihydroxyguaianolide **2** which we named magnograndiolide. The molecular formula could not be obtained directly from the mass spectrum. However, the fragments  $m/z$  251  $[M - Me]^+$  and 284  $[M - H_2O]^+$  obviously required the molecular formula  $C_{15}H_{22}O_4$ . In agreement with this assumption the  $^1H$ NMR spectrum (Table 1) showed two methyl singlets at relatively low field. Irradiation of the five-fold doublet at  $\delta$  2.69 showed that it had to be assigned to H-7. Further spin decoupling studies allowed the assignment of the sequence (H-1 to H-3 and H-1, H-5 to H-9), thus leading to the formulation of the new compound as the guaianolide **2**. The stereochemistry at C-1, C-5, C-6 and C-7 could be deduced from the couplings observed from the NMR data. Furthermore, NOE difference spectra revealed effects between H-7, H-5, H-8 $\alpha$  and H-9 $\alpha$  as well as between H-1, H-5 and H-9. The NOE also revealed the correlation between H-6 $\beta$  and both methyl singlets at  $\delta$  1.29 and 1.34. However, that at 1.29 was more enhanced and thus was assigned to C-15 (Table 1). Most likely compound **2** was formed via parthenolide **1** as indicated in Scheme 1.

finely powdered and exhaustively extracted with EtOH. The residue (420 g) was partitioned between  $H_2O$  and  $CHCl_3$ . The  $CHCl_3$  extract (140 g) was dissolved in MeOH (150 ml) to which hot  $H_2O$  (250 ml) was added. The soln was repeatedly extracted with petrol followed by  $CHCl_3$ . The  $CHCl_3$ -free residue (7 g) was chromatographed on silica gel (Merck, 150 g) by gradient elution using  $C_6H_6$ -MeOH. Fractions of about 50 ml each were collected and examined by TLC (silica gel and  $C_6H_6$ -MeOH, 9:1).

**Parthenolide.** The residue (1.2 g) obtained from fractions 21–30 using 0.5% MeOH in  $C_6H_6$ , was crystallized from petrol-Et<sub>2</sub>O to yield 440 mg of colourless prisms; mp 114–115°. Spectral data (IR, MS and  $^1H$ NMR) proved identity with parthenolide [1, 2].

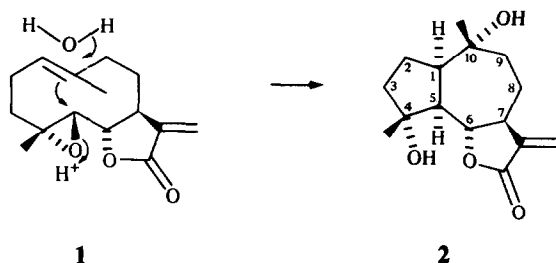
Table 1.  $^1H$ NMR spectral data of **2** (400 MHz,  $CDCl_3$ , TMS as internal standard)

H-1	2.63 ddd
H-2 $\alpha$	1.97 dddd
H-2 $\beta$	1.61 dddd
H-3 $\alpha$	1.84 ddd
H-3 $\beta$	1.81 ddd
H-5	2.39 dd
H-6	4.24 dd
H-7	2.69 dddd
H-8 $\alpha$	2.14 dddd
H-8 $\beta$	1.47 dddd
H-9 $\alpha$	1.70 ddd
H-9 $\beta$	2.00 ddd
H-13	6.24 d
H-13'	5.54 d
H-14	1.34 s
H-15	1.29 s
OH	2.52 s

$J$  (Hz): 1, 2 $\alpha$  = 9; 1, 2 $\beta$  = 10; 1, 5 = 12; 2 $\alpha$ , 2 $\beta$  = 12.5; 2 $\alpha$ , 3 $\alpha$  = 7; 2 $\alpha$ , 3 $\beta$  = 1; 2 $\beta$ , 3 $\alpha$  = 12.5; 2 $\beta$ , 3 $\beta$  = 7; 3 $\alpha$ , 3 $\beta$  = 13; 5, 6 = 12; 6, 7 = 9.5; 7, 8 $\alpha$  = 4; 7, 8 $\beta$  = 11.5; 7, 13 = 3.5; 7, 13' = 3; 8 $\alpha$ , 9 $\alpha$  = 4.5; 8 $\alpha$ , 8 $\beta$  = 14; 8 $\alpha$ , 9 $\beta$  = 4; 8 $\beta$ , 9 $\alpha$  = 13; 8 $\beta$ , 9 $\beta$  = 3.5; 9 $\alpha$ , 9 $\beta$  = 13.

### EXPERIMENTAL

The dried leaves (2.7 kg), collected from trees cultivated in private gardens near Mansoura (Egypt) in the spring 1981, were



Scheme 1.

*Costunolide diepoxide*. The residue (0.5 g) obtained from fractions 36–50 using 1–2% MeOH afforded, after further fractionation on silica gel (Woelm, 120 g) using  $C_6H_6$ –Me<sub>2</sub>CO gradient, 20 mg of minute needles; mp 169–170°. Spectral data (IR and MS) indicated identity with costunolide diepoxide [2].

*Magngrandiolide* (2). The residue (0.8 g) obtained from fractions 61–90 using 5–20% MeOH afforded, after further fractionation on silica gel (Woelm, 130 g) using  $C_6H_6$ –Me<sub>2</sub>CO gradient, 170 mg of colourless prisms; mp 176–177°; IR  $\nu_{max}^{KBr}$  cm<sup>-1</sup>: 3480 (OH), 1770 ( $\gamma$ -lactone); MS  $m/z$  (rel. int.): 251  $[M - Me]^+$  (9), 248.141  $[M - H_2O]^+$  (11) (calculated for C<sub>15</sub>H<sub>20</sub>O<sub>3</sub>), 233  $[248 - Me]^+$  (8), 230  $[248 - H_2O]^+$  (24), 215

$[230 - Me]^+$  (21), 191 (41), 190 (72), 187 (31), 91 (68), 71 (94), 43 (100).

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## XANTHANOLIDES FROM *XANTHIUM SPINOSUM*

ABDALLAH A. OMAR, ELSAYED M. ELRASHIDY, NABILA A. GHAZY, ALI M. METWALLY, JÜRGEN ZIESCHE\* and FERDINAND BOHLMANN\*

College of Pharmacy, University of Alexandria, 21521, Egypt; \*Institute for Organic Chemistry, Technical University of Berlin, D-1000 Berlin 12, West Germany

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**Key Word Index**—*Xanthium spinosum*; Compositae; sesquiterpene lactones; xanthanolides.

**Abstract**—The aerial parts of *Xanthium spinosum* afforded in addition to known xanthanolides three new ones. The structures were elucidated by spectroscopic methods and by partial synthesis. Furthermore one lactone was transformed to a known derivative.

The isolation of only one sesquiterpene lactone, xanthinin, has been reported [1] from *Xanthium spinosum* L. (Compositae, tribe Heliantheae, subtribe Ambrosiinae). A careful reinvestigation afforded also xanthatin (1) [1], the epoxide 2 as well as its isomer 3 and the diol 4. The structures of 2 and 3 followed from the <sup>1</sup>H NMR spectra (Table 1) as all signals could be assigned by spin decoupling. Some signals differed typically, especially the couplings of H-5, but those of H-8 and H-9 were also different. The flexibility of the seven membered ring did not allow a clear assignment of the stereochemistry at C-5 though the downfield shift of H-8 in the spectrum of 2, if compared with the corresponding chemical shift of H-8 in the spectrum of 3, supported the proposed stereochemistry. Furthermore, inspection of models showed that the couplings observed agreed best with the stereochemistry. The <sup>1</sup>H NMR spectrum of 2 also differed clearly from that of the corresponding 8-epimer [2] further supporting the proposed stereochemistry at C-8. Partial epoxidation of 1 afforded a 1:5 mixture of 2 and 3. The expected favoured addition from the  $\alpha$ -face led to an epoxide which was identical with 3 thus establishing the proposed assignment of the stereochemistry of 2 and 3.

The <sup>1</sup>H NMR spectrum of 4 (Table 1) showed that a xanthanolide was present where the keto group was

reduced, as an additional methyl doublet at  $\delta$ 1.23 was obviously due to H-15. Irradiation at 4.07 collapsed this doublet to a singlet and also changed the threefold doublets at 1.54 and 1.70 to double doublets. These signals were further coupled with an overlapped signal at 4.30. Accordingly, the side chain at C-1 was very likely to be that proposed. Acetylation afforded the diacetate 5, identical with a diacetate isolated previously from a *Pulicaria* species [3]. The stereochemistry at C-1 and C-4 could not be determined.

The chemistry of this species again shows that xanthanolides are characteristic for the genus *Xanthium*, where so far these lactones have always been isolated [4]. However, these lactones are also isolated from some *Parthenium* and *Iva* species [4].

#### EXPERIMENTAL

The aerial parts (2.4 kg) of the plant collected near Alexandria were extracted by percolation with Et<sub>2</sub>O–petrol (1:2) and the extract was dissolved in 2 l. EtOH (95%). The soln was separated from insoluble waxy material, concd and gradually treated with 0.5 l. H<sub>2</sub>O. The soln in EtOH–H<sub>2</sub>O (1:1) was extracted with petrol and CHCl<sub>3</sub>. The petrol extract after evaporation and recrystallization afforded 150 mg xanthinin. The CHCl<sub>3</sub> soln was