A New Highly Oxygenated Pseudoguaianolide from a Collection of the Flowers of *Parthenium hysterophorus*[1)]

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A new highly oxygenated pseudoguaianolide, 8-β-acetoxyhysterone C, along with the known compounds, parthenin, coronopilin and hysterone C, has been isolated from a collection of the flowers of *Parthenium hysterophorus*. The structure of the new compound was derived from the extensive studies of its spectral (mainly 1D and 2D NMR) data.

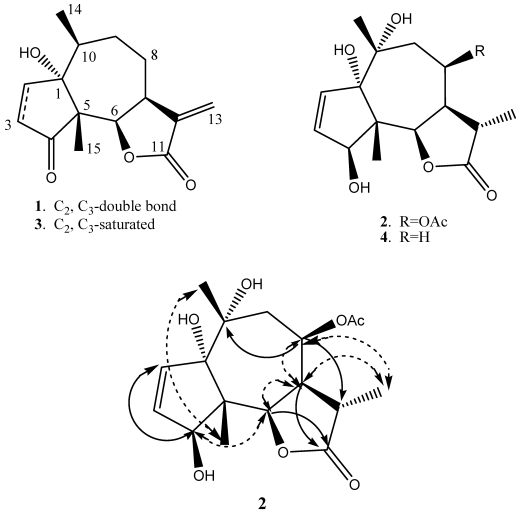
Key words *Parthenium hysterophorus*; pseudoguaianolide; 8-β-acetoxyhysterone C

Parthenium hysterophorus Linn (Compositae), an obnoxious weed, grows wild in different regions of India. The plant is known to create contact dermatitis and allergic rhinitis in animals[2)] and to possess significant allelopathic properties.[3,4)] Parthenin (**1**)[5)] was reported to be the major bioactive constituent of the plant. The compound was shown to exhibit promising cytotoxic and allelopathic activities.[3—6)]

In continuation of our recent work[7,8)] on the constituents of different parts of *Parthenium hysterophorus* we report here the isolation of a new pseudoguaianolide, 8-β-acetoxyhysterone C (**2**) along with the known compounds, parthenin (**1**),[5)] coronopilin (**3**)[9)] and hysterone C (**4**)[7)] from a collection of the flowers of the plant (Fig. 1). The new compound (**2**) was isolated as a viscous mass. Its molecular formula was assigned to be $C_{17}H_{24}O_7$ from its elemental analysis, LSI-MS (m/z 341, $M^{+\bullet}+1$), and ^{13}C-NMR spectrum (showing the presence of 17 carbons in the molecule). The IR spectrum suggested the presence of hydroxyl, ester and lactone carbonyl groups in the molecule. The structure of the compound was derived from its ^{1}H- and ^{13}C-NMR values which clearly indicated[7)] the compound to be a pseudoguaianolide related to parthenin (**1**). In ring A, a C-2, C-3 double bond was present in **2** but the carbonyl group at C-4 was replaced by a hydroxyl (δ 6.22, 1H, dd, J=6.0, 1.5 Hz, H-2; 5.94, 1H, dd, J=6.0, 2.4 Hz, H-3; 5.08, 1H, dd, J=2.4, 1.5 Hz, H-4). The DQF-COSY spectrum clearly showed a correlation between H-2 and H-3, H-3 and H-4 and H-2 and H-4. However, the double bond in ring C (that is, C-12, C-13 double bond) was saturated (δ 2.34, 1H, m, H-12; 1.24, 3H, d, J=7.0 Hz, Me-13). The DQF-COSY spectrum showed a correlation between Me-13 and H-12, H-12 and H-7 (δ 2.48, 1H, m) and H-7 and H-6 (δ 5.21, 1H, d, J=8.6 Hz). The two methyl groups (Me-14, Me-15) appeared as singlets while Me-14 of parthenin (**1**) was doublet.[5)] An –OH group was thus placed at C-10 in **2**. This structural feature has been observed earlier in another known constituent, hysterone C (**4**)[7)] whose structure was settled by X-ray crystallographic analysis. A comparison of the ^{1}H- and ^{13}C-NMR spectral data of **2** with those of **4** clearly suggested that the former is closely related to the latter having only an additional acetoxy group. This acetoxy group was reasonably placed at C-8 in **2** as DQF-COSY experiment showed a correlation between H-8 (δ 4.48, 1H, m) and H-7 and also between H-8 and H_2-9 (δ 1.86—1.62, 2H, m).

The ^{13}C-NMR spectrum of **2** revealed the presence of signals for seventeen carbons (*vide* Experimental) including those for an acetoxy group (δ 171.0, 21.3). The DEPT and HMBC experiments were helpful to assign the values to these carbons. The HMBC experiment (Fig. 1) also showed that H-8 was correlated to the carbonyl function of the acetoxy group confirming the placement of the acetoxy group at C-8. In the NOESY experiment (Fig. 1), H-4 was found to correlate with H-6 but not with Me-15 (δ 15.3) indicating the β-configuration of the hydroxyl group at C-4. Me-14 and Me-15 were correlated but they were not related to Me-13 which was related to H-6, H-7 and H-8. These correlations suggested the β-orientation of Me-14 and Me-15 while α-orientation of Me-13 and H-8. The structure of the new pseudoguaianolide was thus clearly settled as 8-β-acetoxyhysterone C (**2**).

The known compounds, parthenin (**1**),[5)] coronopilin (**3**)[9)] and hysterone C (**4**),[7)] isolated from the same plant part, were characterized by comparison of their physical (TLC, mp, and $[\alpha]_D$) and spectral (IR, ^{1}H-NMR, MS) properties with those of authentic samples available in our laboratory. All the constituents were found (by TLC) to be present in the original



Selected HMBC (→), and NOESY (←·····→) correlations of **2**

Fig. 1

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extract of the plant materials.

Experimental

Melting points were measured in a Buchi-510 instrument and are uncorrected. The spectra were recorded with the following instruments: IR: Perkin Elmer spectrophotometer, ^{1}H- and ^{13}C-NMR: Varian Gemmini 200 MHz spectrometer and LSI-MS: Finnigan-MAT 1020 instrument. Optical rotations were determined with a Jasco DIP 360 digital polarimeter. Column chromatography was performed with silica gel (BDH, 100—200 mesh) and TLC with silica gel GF_{254}.

Plant Materials The flowers of *Parthenium hysterophorus* were collected from West Bengal in the month of July, 2003 and were botanically identified. A voucher specimen (IICT-5210) was preserved in the herbarium of Indian Institute of Chemical Technology.

Extraction and Isolation The air-dried and powdered plant materials (1 kg) was extracted with $CHCl_3$–MeOH (1 : 1, 3 l) at room temperature for 120 h. The extract was concentrated under reduced pressure to afford a gummy mass (18 g). The residue was subjected to column chromatography over silica gel using solvents of increasing polarity from *n*-hexane through EtOAc. The following compounds were obtained according to the increasing order of polarity: coronopilin (18 mg), parthenin (7.4 g), 8-β-acetoxyhysterone C (16 mg) and hysterone C (24 mg) (Fig. 1).

8-β-Acetoxyhysterone C: Viscous mass, $[\alpha]_D^{25}$ +32.67° (c=0.08, MeOH); IR (KBr) ν_{max} cm^{-1}: 3404, 1765, 1720, 1652, 1582; ^{1}H-NMR ($CDCl_3$) δ: 6.22 (1H, dd, J=6.0, 1.5 Hz, H-2), 5.94 (1H, dd, J=6.0, 2.4 Hz, H-3), 5.21 (1H, d, J=8.6 Hz, H-6), 5.08 (1H, dd, J=2.4, 1.5 Hz, H-4), 4.48 (1H, m, H-8), 2.48 (1H, m, H-7), 2.34 (1H, H-12), 1.86—1.62 (2H, m, H_2-9), 1.35 (3H, s, Me-15), 1.24 (3H, d, J=7.0 Hz, Me-13), 1.22 (3H, s, Me-14); ^{13}C-NMR ($CDCl_3$) δ: 180.2 (C-11), 171.0 (–O–CO–Me), 138.2 (C-2), 132.5 (C-3), 87.3 (C-1), 85.1 (C-4), 82.2 (C-8), 81.9 (C-6), 77.4 (C-10), 57.4 (C-5), 46.7 (C-12), 42.5 (C-7), 36.2 (C-9), 25.0 (Me-14), 21.3 (–O–CO–Me), 15.3 (Me-15), 12.8 (Me-13); LSI-MS m/z: 341 ($M^{+\cdot}$+1); *Anal.* Calcd for $C_{17}H_{24}O_7$: C, 60.0; H, 7.06%. Found: C, 59.86; H, 7.12%.

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