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ORIGINAL ARTICLE

A xanthone glycoside from aerial parts of *Swertia paniculata*

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Abstract Column chromatography of purified butanol extract obtained after fractionation from aqueous methanolic extract of aerial parts of *Swertia paniculata* afforded one xanthone glycoside (1,5-dihydroxy-3-methoxyxanthone-8-*O*-β-D-glucopyranoside). Structure of this compound was elucidated using spectroscopic techniques. This is the first report of isolation of this compound from *S. paniculata*.

1. Introduction

Swertia paniculata WALL (D. Don), family Gentianaceae, is widely distributed throughout the temperate region of the Western Himalayas at altitudes of 5000–8000 ft, from Kashmir to Nepal and in the Lushai hills of Mizoram at altitudes of 1500–2400 m. It is used in the Indian system of medicine (ISM) as a bitter tonic and in the treatment of certain mental disorders, such as melancholia (Chopra et al., 1956).

The plant *S. paniculata* is generally used as a substitute of *Swertia chirata* in many herbal formulations (Anonymous, 1966). Literature survey revealed that not much work was done on the aerial parts of the plant. Various compounds namely, pentaoxygenated xanthone (Prakash et al., 1982), tetraoxygenated xanthones (Prakash et al., 1982; Khan et al., 1977), flavonoids (Khetwal and Verma, 1984), steroids (Pant et al., 2002; Khetwal and Verma, 1984; Khan et al., 1977), triterpenes (Khetwal and Verma, 1984; Prakash et al., 1982; Khan et al., 1977), xanthone glycosides (Pant et al., 2002; Prakash et al., 1982) and long chain aliphatic compounds (Pant et al., 2002) have reported from this plant. Phytochemicals from genus *Swertia* and their biological activities have already been reviewed (Brahmachari et al., 2004).

In the present work we have investigated the fractionated butanol extract obtained from aqueous methanolic extraction of aerial parts of *S. paniculata* and isolated one xanthone glycoside namely 1,5-dihydroxy-3-methoxyxanthone-8-*O*-β-D-glucopyranoside (Fig. 1).

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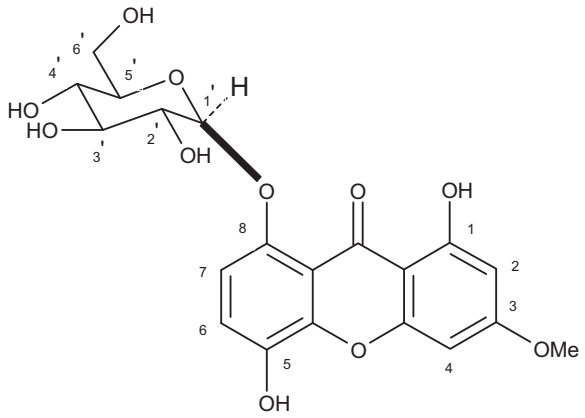

Figure 1 1,5-Dihydroxy-3-methoxyxanthone-8-*O*-β-D-glucopyranoside (**1**).

2. Material and methods

2.1. General

Melting point was determined on electro thermal (UK-made) apparatus on centigrade scale and was uncorrected. Ultra-violet absorption spectrum was recorded on Perkin-Elmer Lambda Bio 20 UV spectrophotometer. Infrared spectrum was recorded on Perkin-Elmer 1710 infrared Fourier Transform spectrometer. ^{1}H and ^{13}C NMR were recorded on a Bruker AVANCE DRX-300 (300 and 75 MHz) equipped with 5 mm inverse multinuclear probe head. Tetramethyl silane (TMS) was used as an internal standard and chemical shift values are expressed in δ (ppm) values, coupling constant (J) in Hertz. ESMS, electro spray mass spectra, were recorded on a Micromass Quattro II triple quadrapole mass spectrometer. EIMS, electron impact mass spectra, were recorded at 70 eV on JEOL-JMS D-100 spectrometer. Column chromatography was performed over silica gel (60–120 mesh, Qualigen) and TLC was carried out on a silica gel G (10–40 μ, Merck). Paper chromatography (PC) was carried out on Whatman paper number 1 in descending mode in *n*-BuOH–AcOH–H_2O (4:1:5, v/v/v), developed by spraying with silver nitrate solution in acetone followed by NaOH solution in methanol.

2.2. Plant material

S. paniculata Wall (D. Don), family Gentianaceae, aerial parts were collected from Bharmour (Chamba) Palampur, Himachal Pradesh (9000 ft height) and identified by Dr. S. P. Jain, *Scientist*, Botany and Pharmacognosy Division, Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, where a voucher specimen No. 11470 has been retained.

2.3. Extraction and isolation

The air-dried and powdered aerial parts (5 Kg) of *S. paniculata* were extracted with aqueous methanol (20%) to yield aqueous methanolic extract, which was filtered and the filtrate was concentrated up to one liter and then fractionated with *n*-hexane, chloroform, ethyl acetate and butanol (Ahmad et al., 2004). The *n*-butanol extract (46.38 g) thus obtained was further fractionated to purify the extract. In the *n*-butanol extract (44 g), water was added (70 ml) and then extracted with chloroform (30 mL × 3) to yield chloroform extract (4.69 g). The remaining water was concentrated to half and then fractionated with acetonitrile by adding salt (NaCl) to yield acetonitrile extract (16 g) and water extract (32.73 g). Column chromatography of acetonitrile extract (16 g) was packed in chloroform and elution was carried out with increasing polarity of chloroform–methanol (94:6, 92:8, 90:10, 85:15, 80:20, v/v). Similar fractions were pooled together on the basis of TLC behavior. One major compound **1** was isolated from fraction number 30–35, while eluting the column with chloroform–methanol (85:15) as yellow powder. Compound 1 is isolated for the first time from *S. paniculata*.

2.4. 1,5-Dihydroxy-3-methoxyxanthone-8-O-β-D-glucopyranoside (*1*)

Yellow powder (32.6 mg, 0.000652%, w/w), m.p. 194–196 °C, $C_{20}H_{20}O_{11}$ (M^+ 436), R_f 0.32 ($CHCl_3$–MeOH, 88:12, v/v), IR ν_{max} (KBr): 3410 (OH), 2400 (C–H), 1740 (C=O), 1700, 1650, 1560 cm^{-1}. UV λ_{max} (EtOH): 224, 253, 276, 325 nm. ^{1}H NMR (300 MHz, Py-d_5): δ 3.63 (3H, s, OCH_3), 4.16–4.66 (6H, m, sugar protons), 5.47 (1H, d, J 7.2 Hz, H-1′), 6.20 (1H, d, J 2.4 Hz, H-2), 6.48 (1H, d, J 2.4 Hz, H-4), 7.38 (1H, d, J 8.7 Hz, H-6), 7.60 (1H, d, J 8.7 Hz, H-7). ^{13}C NMR (75 MHz, Py-d_5): 164.2 (C-1), 98.0 (C-2), 167.1 (C-3), 92.3 (C-4), 157.5 (C-4a), 146.5 (C-4b), 143.0 (C-5), 122.2 (C-6), 113.4 (C-7), 151.1 (C-8), 113.9 (C-8a), 106.0 (C-8b), 182.5 (C-9), 56.0 (OCH_3). Glc moiety: 104.9 (C-1′), 75.5 (C-2′), 78.0 (C-3′), 71.5 (C-4′), 79.6 (C-5′), 62.8 (C-6′). ESMS m/z: 459.2 $(M+Na)^+$, 437.1 $(M+H)^+$ 436$(M)^+$ $C_{20}H_{20}O_{11}$ MS m/z: 274 $(M-\text{glucose unit})^+$ $C_{14}H_{10}O_6$ (100), 245 $(M-29)^+$ (21), 231 $(M-43)^+$ (12), 217 $(M-55)^+$ (25), 204 (14), 153 (12), 138 (17), 123, 73, 69, 43.

2.5. Acidic hydrolysis of *1*

Isolated xanthone glycoside (6.0 mg) was refluxed with 15% methanolic HCl (5 mL) for 4 h, on completion of the reaction, reaction mixture was diluted with water and extracted with chloroform (15 mL × 4) and dried over anhydrous sodium sulphate. Solvent was evaporated and recrystallized in chloroform to furnish the aglycon, m.p. 265–267 °C. UV λ_{max} (EtOH): 227, 239, 253, 274, 294, 334 nm; EIMS: m/z 274 $[M]^+$ correspond to molecular formula $C_{14}H_{10}O_6$. Aqueous mother liquor was neutralized with $BaCO_3$ and filtered. The filtrate was concentrated and checked for sugar on paper chromatography (PC) with the authentic sample and was identified as D-glucose.

3. Results and discussion

Compound **1** was obtained as a yellow powder from chloroform–methanol (85:15) fractions, m.p. 194–196 °C. The IR spectrum showed the presence of hydroxyl group (3410 cm^{-1}) and a carbonyl group (1740 cm^{-1}). The mass peak at m/z 436 in ESMS corresponds to the molecular formula $C_{20}H_{20}O_{11}$.

A singlet at δ 3.63 in ^{1}H NMR was assigned for the methoxy protons. The insolubility of compound in 5% aqueous