

A New Flavonol from *Athrixia phyllicoides* (Bush Tea)

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ABSTRACT

Athrixia phyllicoides (bush tea), belonging to the Asteraceae family, is a popular beverage used as a herbal tea and for medicinal purposes. The processed leaves of bush tea contain 5-hydroxy-6,7,8,3',4',5'-hexamethoxyflavon-3-ol as major flavonoid.

KEYWORDS

Athrixia phyllicoides, bush tea, flavonoids, health beverage, phenols.

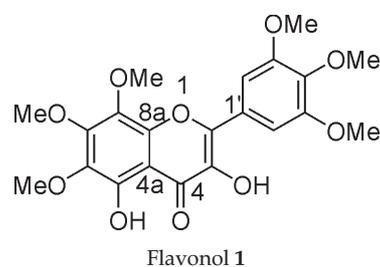
Athrixia phyllicoides DC. (bush tea) belongs to the Asteraceae family.¹ It has small, dark green pointed leaves with white woolly backs and small pink or mauve-pink daisy flowers with a bright yellow centre.² Bush tea is a popular beverage used as a herbal tea and as a medicinal plant for cleansing or purifying the blood, treating boils, headaches, infested wounds and cuts, and the solutions may also be used as a foam bath.³ It is used as an aphrodisiac by Vhavenda people,⁴ and the Zulu people use a decoction of the root as a cough remedy and purgative.⁵ As part of a study of the viability of bush tea as an agricultural enterprise, we investigated the flavonoid and phenolic constituents of *A. phyllicoides*. In herbal teas, flavanols and polyphenols are the potential quality indicators since they are antioxidant in nature. Flavonoids have a wide range of physiological activity (for example cAMP diphosphoesterase inhibition,⁶ growth inhibition,⁷ and cytotoxicity^{8,9}) and their presence in any traditional remedy or beverage is therefore significant.

Compound **1** (C₂₁H₂₂O₁₀) is a flavonol characterized here for the first time. Its structure was deduced from the data obtained from ¹H and ¹³C NMR experiments. The proton connectivity pattern was determined by analysis of the proton–proton coupling constants and the correlations observed in the ¹H-¹H COSY spectrum. The signals of the proton-bearing carbon atoms were correlated with specific proton resonances in a ¹H-¹³C COSY experiment, which allowed the assignment of the structure (**1**) to the flavonol.

The ¹H NMR spectrum is dominated by five singlets (δ_{H} 4.02, 3.97, 3.93, 3.92 (6H), 3.88 ppm) due to six methoxy groups. Two aromatic protons resonate as a singlet at δ_{H} 7.47 ppm, leading to the conclusion of a 3',4',5'-trimethoxyphenyl substituent. A one-proton singlet at δ_{H} 12.46 ppm is typical of a strongly hydrogen-bonded hydroxyl group, and a very weak singlet at δ_{H} 6.49 indicated the presence of a phenolic hydroxyl group. In the ¹³C NMR spectrum the six methoxy groups were again clearly discernible at δ_{C} 56.24 (2 Me groups), 60.27, 61.00, 61.03, and 61.60 ppm. Apart from six aromatic carbon atoms, an enone carbonyl resonating at δ_{C} 179.30 ppm and two alkene carbon atoms at δ_{C} 155.1 and 130.49 ppm complete the structure.

Experimental

Silica gel (0.063–0.2 mm) was used as stationary phase and a mixture of hexane and ethyl acetate used as mobile phase in the



Flavonol 1

chromatographic separations. Thin layer chromatography plates, packed with silica gel, were used to isolate major components of the fractions from the minor ones. Thin layer chromatography plates were visualized under UV light (254 nm) or by spraying with visualizing reagent (anisaldehyde reagent) which was made up by mixing 250 mL ethanol, 2.4 mL concentrated sulphuric acid and 6 mL anisaldehyde. NMR spectroscopic measurements were made using a 300 MHz Bruker spectrometer, with CDCl₃ as solvent and TMS as an internal standard.

The plant material was harvested in Muhuyu village, Limpopo Province. The green leaves (567 g) were cold-extracted with acetone for seven days. The extract was filtered and evaporated at 50°C under reduced pressure to yield 312 g of a green viscous liquid. Thirty grams silica was added and the mixture evaporated to dryness. The dry mixture was added on top of a chromatographic column containing 250 g of silica gel with hexane as mobile phase. The mixture was chromatographed with a hexane:ethyl acetate gradient of increasing polarity to yield several low polarity phytosterol mixtures and a more polar, yellowish, crystalline product identified as 5-hydroxy-6,7,8,3',4',5'-hexamethoxyflavon-3-ol (**1**).

Identification of the Isolate

30 mg crystallized as yellowish crystals from hexane/ethyl acetate (m.p. 127–129.5°C); δ_{H} (300 MHz, CDCl₃) 3.88 (3H, s, OMe), 3.92 (6H, s, 2x OMe), 3.93 (3H, s, OMe), 3.97 (3H, s, OMe), 4.02 (3H, s, OMe), 6.49 (1H, s, 5-OH), 7.47 (2H, s, 2'-H and 6'-H), 12.46 (1H, s, 3-OH); δ_{C} (100 MHz, CDCl₃) 56.24 (3'-OMe and 5'-OMe), 60.27 (6-OMe), 61.00 (4'(or 7)-OMe), 61.03 (7(or 4')-OMe), 61.60 (8-OMe), 106.01 (C-4a), 122.23 (C-8), 125.53 (C-1'), 127.08 (C-6), 130.49 (C-3), 139.06 (C-2' and C-6'), 140.70 (C-4'), 144.83 (C-8a), 147.95 (C-5), 148.82 (C-7), 153.20 (C-3' and C-5'), 155.14 (C-2), 179.30 (C-4).

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