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

Mahlori J. Mashimbye*, Fhatuwani N. Mudau*, Puffy Soundy* and Teunis van Ree**

*Department of Chemistry and Department of Horticultural Sciences, University of Venda for Science and Technology, Private Bag X5050, Thohoyandou, 0950 South Africa.

**Department of Plant Production and Soil Science, University of Pretoria, Pretoria, 0002 South Africa.

ABSTRACT

*Athrixia phylicoides* (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 phylicoides*, bush tea, flavonoids, health beverage, phenols.

---

*Athrixia phylicoides* DC. (bush tea) belongs to the Asteraceae family. It has small, dark green pointed leaves with white woolly backs and small pink or mauve-pink daisy flowers with a bright yellow centre. 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. It is used as an aphrodisiac by Vhavenda people, and the Zulu people use a decoction of the root as a cough remedy and purgative. As part of a study of the viability of bush tea as an agricultural enterprise, we investigated the flavonoid and phenolic constituents of *A. phylicoides*. 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, growth inhibition, and cytotoxicity) and their presence in any traditional remedy or beverage is therefore significant.

Compound 1 (C$_{21}$H$_{22}$O$_{10}$) is a flavonol characterized here for the first time. Its structure was deduced from the data obtained from $^1$H and $^{13}$C NMR experiments. The proton connectivity pattern was determined by analysis of the proton–proton coupling constants and the correlations observed in the $^1$H-$^1$H COSY spectrum. The signals of the proton-bearing carbon atoms at $\delta$ 3.97, 3.93, 3.92 (6H), 3.88 ppm) due to six methoxy groups. Two one-proton singlet at $\delta$ 12.46 ppm is typical of a strongly hydrogen-bonded hydroxyl group, and a very weak singlet at $\delta$ 6.49 indicated the presence of a phenolic hydroxyl group. In the $^{13}$C NMR spectrum the six methoxy groups were again clearly discernible at $\delta$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 $\delta$C 179.30 ppm and two alkene carbon atoms at $\delta$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 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 CDCl$_3$ 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); $\delta$$_n$ 300 MHz (CDCl$_3$) 3.88 (3H, s, OMe), 3.92 (6H, s, 2x OMe), 3.93 (3H, s, OMe), 3.97 (3H, s, OMe), 4.02 (3H, s, OMe), 6.49 (1H, s, 5-OH), 7.47 (2H, s, 2'-H and 6'-H), 12.46 (1H, s, 3-OH); $\delta$$_{c}$ 100 MHz (CDCl$_3$) 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).
Acknowledgements

We thank Mashudu Shaila Mangaka for technical assistance, Prof. Robert Vleggaar (University of Pretoria) for NMR spectroscopy, and the National Research Foundation (NRF) for financial assistance.

References