A 2-PHENOXYCHROMONE FROM *Artemisia rupestris*

Haji Akber Aisa, Yun Zhao, and Chengxiang He

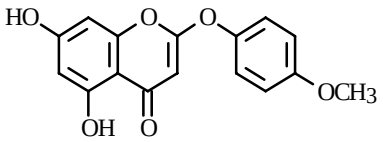
UDC 547.972

*A 2-phenoxychromone, 6-demethoxy-4′-*O*-methylcapillarisin, was isolated from* Artemisia rupestris *L. The structure of this compound was established by analysis of the spectroscopic data. A single-crystal diffraction analysis was performed in order to confirm the proposed structure.*

Key word: 2-phenoxychromone, 6-demethoxy-4′-*O*-methylcapillarisin, single-crystal diffraction analysis.

Artemisia rupestris L. (Compositae) is widely distributed in the Xinjiang Uygur autonomous region of China, central Asia, Europe, etc. It is used in Xinjiang folk medicine to cure dyspepsia, gastrectasia, hepatitis, urticaria, snakebite, etc. It was reported that this herb has antiinflammatory, antihypersusceptibility, anticancer, immuno-enhancing, antimicrobial, and especially, hepatoprotector properties [1]. Pharmacological studies of this plant have revealed its anticancer, hepatoprotector, smooth muscle stimulant antioxidant properties, etc.

Isorupestonic acid, rupestonic acid, rupestric acid, aciphyllic acid, *cis*- and *trans*-spiroketalenoetherpolne, gardenin D, β-sitosterol, β-sitosterol-3-*O*-β-glucoside, palmitic acid, and several flavonoid derivatives have been reported previously in the literature as the main compounds [1–3]. During a survey of the constituents of this plant, a 2-phenoxychromone, 6-demethoxy-4′-*O*-methylcapillarisin, was found.



2-Phenoxychromones possess a unique flavone-like skeleton in which the A/C ring is linked to the B-ring via an oxygen atom. To our knowledge, there are a few plants that are known source of this rare group of natural products, including *Artemisia capillaries* [4], *Ageratum conyzoides* [5], *Rosa rugosa Thunb.* [6], *Cassia obtusifolia* [7], *Rosa woodsii* [8], *Epimedium sagitatum* [9], *piliostigma thonningii(schum)* [10], *Achillea ageratum* [11], *Mimosa tenuiflora* [12], etc.

This compound is isolated for the first time from *Artemisia rupestris* L.

To the best of our knowledge, 2-phenoxychromones have not been reported in any other plants, except for the nine plants mentioned above and the title plant. All of these plants belong to very different families like *Compositae* [4, 5, 11], *Rosaceae* [6, 8], *Berberidaceae* [9], and *Caesalpiniaceae* [7, 10, 12]. In spite of that, apart from 6-demethoxy-4′-*O*-methylcapillarisin, only eleven 2-phenoxychromones have been described so far [12]. The present paper is the fourth report on their occurrence in *Compositae*. For the compound 6-demethoxy-4′-*O*-methylcapillarisin, this paper is the fifth report [4, 6, 8, 12].

6-Demethoxy-4′-*O*-methylcapillarisin: white crystals; mp. 222–225°C; IR (KBr, ν, cm^{-1}): 3420 (br, ν_{OH}), 1652 (C=O), 1618, 1572, 1502, 1460 (aromatic C=C bond), 1223, 1022 (C-O-C), 822 (*p*-substitutuent).

For the ^1H NMR (DMSO-d_6) and ^{13}C NMR (DMSO-d_6), see Table 1.

Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi, 830011, China, fax: +86 991 3835679, e-mail: haji@ms.xjb.ac.cn. Published in Khimiya Prirodnykh Soedinenii, No. 1, pp. 14-15, January-February, 2006. Original article submitted May 30, 2005.

 0009-3130/06/4201-0016

TABLE 1. ^{1}H and ^{13}C NMR Spectral Data of the Isolated Phenoxychromones

Atom	C	H
2	167.770	-
3	99.345	5.04 s
4	183.091	-
5	161.412	-
6	93.989	6.19 d (1.98)
7	163.936	-
8	87.103	6.35 d (2.14)
9	154.963	-
10	102.005	-
1′	144.379	-
2′/6′	121.999	7.05 d (9.16)
3′/5′	115.440	7.32 d (9.16)
4′	157.814	-
4′-OMe	55.532	3.76 s
5-OH	-	12.79 br
7-OH	-	10.82 s

EXPERIMENTAL

Melting points were determined on a Fisher-Johns apparatus and were uncorrected. IR spectra were measured on a Nicolet FTIR-Magna 750 spectrophotometer (KBr). NMR spectra were obtained on a Brucker AM-400 spectrometer using TMS as internal standard. A MAF-95 double focusing spectrometer was used to record mass spectra. 100–200 mesh and 200–300 mesh silica gel (made in the Qindao Ocean Chemical Factory) were used for column chromatography. All the solvents used in the experiment were of analytical grade.

The aerial parts of *Artemisia rupestris* L. were collected in Hami (Xinjiang region, PRC) on July 2000. The voucher speciments were identified by a Kelimu researcher (Xinjiang Institute of Ecology and Geography Chinese Academy of Sciences).

Ground air-dried raw material (15 kg) were treated with ethanol (70%), refluxed, and the combined ethanol extract evaporated in vacuum. The condensed solution was diluted with water and successively treated with petroleum ether, ethyl acetate, and butanol. The solvents were removed to afford petroleum ether (550 g), ethyl acetate (480 g), and butanol (223 g) fractions.The ethyl acetate fraction (472) was chromatographed over a silica-gel (100–200 mesh) column with gradient elution by petroleum ether–EtOAc mixtures of increasing polarity. A total of 927 fractions of 500 mL each were collected [fr.A1-A5 (petroleum ether); A 6–A33 (20:1); A34–A97 (16:1); A98–A135 (12:1); A136–A207 (8:1); A208–A313 (6:1); A314–A492 (4:1); A493–A565 (2:1); A566–A639 (1:1); A640–A698 (1:2); A699–A733 (1:4); A734–A796 (1:6); A797–A838 (1:8); A839–A883 (1:12); A884–A927 (1:16). Fractions A314–492 (48.4g) were subjected to column chromatography (200–300 mesh) and eluted with petroleum ether–EtOAc mixtures of increasing polarity. Beginning with 20:1, 386 fractions were obtained (B1–B386, 250ml each). B124–B196 afforded this 2-phenoxychromone (0.9 g) after crystallization (petroleum ether–EtOAc).

EIMS (70 eV, m/z, %): 301 (16), 300 (100) [M^+], 148 (43), 120 (18), 92 (9), 77 (9), 64 (4), 51 (2).

Crystal Data. $C_{16}H_{12}O_6$, MW: 300.26, monoclinic, p2(1)/c, a = 11.7911 (12), b = 8.4565 (9), c = 14.9929 (16) Å, α = 90°, β = 110.379 (2)°, γ = 90°, V = 1401.4 (3) $Å^3$, F(000) = 624. Data were collected from a $0.635 \times 0.481 \times 0.139$ mm^3 colorless crystal at 20°C with Mo Kα radiation (l = 0.71073 Å) in the Ω and π scan mode. A total of 3231 reflections were measured (1877 independent reflections observed between 1.84 to 28.28° in θ). The structure was solved by direct methods and refined by full–matrix least squares on F^2 with anisotropic temperature factors for non-hydrogen atoms converging at the discrepancy R-factor = 0.0426, (wR^2 = 0.0945). The unit cell contains four molecules with a calculated density of 1.423 Mg/m^3. All Computation were completed by the programme SHELXTL.

The structure of 6-demethoxy-4′-O-methylcapillarisin was confirmed by X-ray analysis and comparison with literature data [7].

The data of ^{1}H NMR (DMSO-d_6) and ^{13}C NMR (DMSO-d_6), IR, and EIMS correspond to the literature [4]; X-ray single-crystal diffraction analysis correspond to the literature [7].

ACKNOWLEDGMENT

This work was supported by the "Modernization of the Traditional Chinese Medicines" project (KGCX-2-SW-213-08).

REFERENCES

1. Sirafil, Askar, Ilhamjan, Xawkat, and Halmurat, *Chin. J. Biochem. Mol. Biol.*, **17**, 2, 226 (2001).
2. Liu Yongmin and Yu dequan, *Acta Pharm. Sin.*, **20**, 7, 514 (1985).
3. Wang Yan, Tuerhong, and Du Niansheng, *J. Xinjiang Med. Univ.*, **27**, 4, 361 (2004).
4. T. Komiya, Y. Narusi, and H. Oshio, *Yakugaku Zasshi*, **96**, 855 (1976).
5. E. K. Adesogan and A. L. Okuande, *J. Chem. Soc., Chem. Commun*., 152 (1978).
6. Yasuyuki Hashidoko, Satoshi Tahara, and Junya Mizutani, *Phytochemistry*, **30**, 11, 3837 (1991).
7. A. Sharon, R. Ghirlando, and J. Gressel, *Plant Physiol.*, **98**, 303 (1992).
8. Y. Hashidoko, S. Tahara, and J. Mizutani, *Phytochemistry*, **31**, 2148 (1992).
9. Y-L. Huang, J-C. Ou, C-F. Chen, and C-C. Chen, *J. Nat Prod.*, **56**, 275 (1993).
10. J. C. Ibewuike, A. O. Ogundaini, F. O. Ogungbamila, M.-T. Martin, J.-F. Gallard, L. Bohlin, and M. Pais, *Phytochemistry*, **43**, 3, 687 (1996).
11. A. Kijjoa, L. M. Vieira, J. A. Pereira, M. S. Artur Silva, and W. Herz, *Phytochemistry*, **51**, 555 (1999).
12. L. Leon, E. Maldonado, A. Cruz, and A. Ortega, *Planta Med.*, **70**, 536 (2004).