Three flavonoids from *Trichosanthes kirilowii* Maxim.

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**Abstract:** Three flavonoids compounds, 5,6,7,8,3′,4′-hexamethoxyflavone (1), 5,6,7,8,4′-pentamethoxyflavon (2), 7,3′-dihydroisofavones (3), were isolated from the fruits of *Trichosanthes kirilowii* Maxim. for the first time, and their structures were established on the basis of spectroscopic methods. The presences of these compounds (1-3) might be employed as the characteristic constituents of Cucurbitaceae family.

**Keywords:** flavonoids, *Trichosanthes kirilowii* Maxim., 5,6,7,8,3′,4′-hexamethoxyflavone, 5,6,7,8,4′-pentamethoxyflavon, 7,3′-dihydroisofavones

1. Introduction

*Trichosanthes kirilowii* Maxim. belongs to the family Cucurbitaceae and is widely distributed in Shandong province, Hebei province, Anhui province in China[1]. Previous phytochemical investigations resulted in the isolation of many compounds including terpenoids, sterols, flavonoids, saccharide derivatives and alkaloids[2]-[6]. In this study compounds (1-3) were isolated for the first time. The structures of these compounds were shown in Fig. 1.

2. The Experiments and Materials

The air-dried bark was exhaustively extracted with 95% ethanol after grounding into powder (20.0kg). The solvent was removed under reduced pressure to afford an extract (1.5kg). Then the extract was successively partitioned with petroleum ether, chloroform, ethyl acetate, and n-butanol. The chloroform extract (110g) was subjected to a silica gel chromatography, eluting with a gradient of CHCl₃/MeOH (100:1-1:1, v/v), to give six fractions (A-F). Fraction C (9.6 g) was applied to silica gel column chromatography, eluting with CHCl₃/MeOH (20:1 to 1:1, v/v), to furnish five fractions (1-5). Fraction 4 (5.3 g) was separated by a column of Sephadex LH-20 eluted with CHCl₃/MeOH 100:3, 100:7, 100:10 and 100:20 to gave compounds 1 (3.2 mg) and 2 (16.6 mg). Compounds 3 (6.4 mg) were obtained by recrystallization from CHCl₃.

3. Result and discussion

Compound 1 was obtained as yellow needles. Its molecular formula was determined as C₂₂H₂₁O₈ by ESI-MS at m/z 403.1315[M+H]⁺. The ¹H and ¹³C NMR spectra indicated six sp³ hybridization of high intensity of hydrogen proton signals; δH 4.02 (3H, s), 3.96 (3H, s), 3.88 (3H, s), 3.88 (3H, s), 3.85 (3H, s) and 3.79 (3H, s), ¹³C-NMR (75 MHz, DMSO-d₆) spectrum shown six carbon signals δC 62.0, 61.9, 61.6, 61.5×2 and 55.6, indicated the existence of 6 methoxy signals. δH 7.65 (1H, d, J = 8.7 Hz), 7.55 (1H, d, J = 1.8 Hz) and 7.16 (1H, d, J = 1.8, 8.7 Hz) revealed

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the structure with a benzene ring with ABX coupling system, benzene ring of carbon signal corresponding to the δC 127.9, 114.8 and 123.1. The 13C-NMR spectra given 21 carbon signals, remove 6 methoxyl matrix signal, the basic with the parent nucleus 15 carbon, speculated that the structure may be flavonoids compounds. δH 6.72 (1H, s) speculated that flavonoids three hydrogen proton signals. The above data, combined with the literature [7], identification the compound as 5, 6, 7, 8, 3’, 4’- hexamethoxyflavone, the NMR spectrum data were shown in Fig. 2, Fig. 3 and Table 1.

Compound 2 was obtained as yellow needles. Its molecular formula was determined as C_{20}H_{20}O_{7} by ESI-MS at m/z 374.1209[M+H]⁺. 1H-NMR (300 MHz, DMSO- d6) spec-
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<table>
<thead>
<tr>
<th>Position</th>
<th>δ (ppm)</th>
<th>δ(ppm)(JinHz)</th>
<th>Position</th>
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<th>δ(ppm)(JinHz)</th>
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<td>8.74 (1H, s)</td>
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<tr>
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<td>124.0</td>
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<td>10</td>
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<td>-</td>
<td>1’’</td>
<td>130.1</td>
<td>-</td>
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<td>8.30 (1H, d, J=2.7 Hz)</td>
<td>2’’</td>
<td>119.3</td>
<td>7.78 (1H, s)</td>
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<tr>
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<td>4’’</td>
<td>134.1</td>
<td>7.72 (1H, m)</td>
</tr>
<tr>
<td>8</td>
<td>112.6</td>
<td>7.52 (1H, dd, J=2.7, 9.0 Hz)</td>
<td>5’’</td>
<td>129.9</td>
<td>7.65 (1H, m)</td>
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</table>

Figure 6: The $^1$H-NMR spectrum of compound 3

Figure 7: The $^{13}$C-NMR spectrum of compound 3

trum included five sp3 hydrogen proton signals at high intensity, δH 4.02 (3 H, s), δH 4.02 (3H, s) × 2, 3.85 (3H, s) and 3.78 (3H, s). $^{13}$C-NMR (75MHz, DMSO – d6) given five carbon signals δC 62.0, 61.9, 61.6, 61.5 and 55.8, indicated the existence of 5 methoxy signals. δH 8.0 (1H, d, J = 8.7 Hz)×2 and 7.14 (1H, d, J = 8.7 Hz), suggested there is a counterpoint to replace benzene ring system, benzene ring of carbon signal corresponding to the δC 123.2, 119.4 and 114.6×2. The $^{13}$C-NMR spectra given 20 carbon signals, remove 5 methoxyl matrix signal, the basic with the parent nucleus 15 carbon, speculated that the structure may be flavonoids compounds. δH 6.77 (1H, s) speculated the position three hydrogen proton signals in flavonoids. The above data, combined with the literature[7], identification the compound as 5, 6, 7, 8, 4’- pentamethoxyflavone, the NMR spectrum data were shown in Table. 1.

Compound 3 was obtained as colorless needles. Its molecular formula was determined as C15H12O4 by ESI-MS at m/z 257.0736[M + H]+. $^{13}$C-NMR (75MHz, DMSO-d6) given fifteen carbon signals, speculated that the structure may be flavonoids compounds. δH 8.74 (1H, s) indicated the structure as isoflavone stem nucleus. δH 8.30 (1H, d, J=2.7 Hz), 8.10 (1H, d, J=9.0 Hz) and 7.52 (1H, dd, J = 2.7, 9.0 Hz), revealed the structure with a benzene ring with ABX coupling system, benzene ring of carbon signal corresponding to the δC 128.7, 116.2 and 112.6. The above data, combined with the literature[8], identification the compound as 7, 3’-dihydroisofavones, NMR spectrum data were shown in Fig. 6, Fig. 7 and Table. 2.

4. Conclusion

The genus *Trichosanthes* (Cucurbitaceae) has approximately 80 species. About 40 species distribute in China, 20 of which are used in Traditional Chinese Medicine. Previous chemical investigation had demonstrated the presences of numerous compounds in the genus *Trichosanthes*. In this paper the phytochemical investigation on *Trichosanthes kirilowii* Maxim. led to the isolations of three flavonoids, including 5,6,7,8,3’,4’- hexamethoxyflavone (1), 5,6,7,8,4’-pentamethoxyflavon (2), 7,3’- dihydroisofavones (3), which were isolated from the fruits of *T. kirilowii* for the first time. Their structures were established on the basis of spectroscopic methods. The presences of these compounds (1-3) might be employed as the characteristic constituents of genus *Trichosanthes* and increased the chemical diversity in the Cucurbitaceae family.

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References

different applications.  


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