刺楸树皮的化学成分

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［摘要］ **目的**：研究刺楸树皮的化学成分，为阐明其活性成分提供依据。**方法**：采用 80% 乙醇进行提取，硅胶柱色谱、ODS 柱色谱及高效液相制备进行分离纯化，波谱分析（核磁共振氢谱、碳谱和质谱）确定结构。**结果**：分离鉴定了 7 个化合物，分别为 3-*O*-α-*L*-阿拉伯糖-28-*O*-α-*L*-鼠李糖-(1→4)-*O*-β-*D*-葡萄糖-(1→6)-*O*-β-*D*-葡萄糖基-常春藤皂苷元酯（Ⅰ），刺楸皂苷 I（Ⅱ），3-*O*-α-*L*-鼠李糖-(1→2)-*O*-α-*L*-阿拉伯糖-28-*O*-β-*D*-葡萄糖-(1→6)-*O*-β-*D*-葡萄糖常春藤皂苷元酯（Ⅲ），刺楸皂苷 B（Ⅳ），丁香树脂醇双葡萄糖苷（Ⅴ），2-甲氧基对苯二酚 4-*O*-[6-*O*-(4-*O*-α-*L*-鼠李糖基)-紫丁香基]-β-*D*-吡喃葡萄糖（Ⅵ），紫丁香苷（Ⅶ）。**结论**：化合物Ⅰ，Ⅲ，Ⅴ，Ⅵ为首次从本属植物中分得。

［关键词］ 刺楸树皮；化学成分；皂苷
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Chemical Constituents from *Kalopanax septemlobus*

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［**Abstract**］ **Objective**: To study the chemical constituents from *Kalopanax septemlobus* and to obtain a more understanding of its active principles. **Method**: Compounds were extracted with 80% ethanol and isolated by column chromatography on silica gel, ODS and prepared with HPLC; the structures were identified by spectroscopic

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[2] 马悦颖，李沧海，郭建友，等. 桂皮醛解热作用及机制的实验研究[J]. 中国实验方剂学杂志，2007，13(4)：22.
[3] 马悦颖，李沧海，李兰芳. 桂皮醛解热镇痛抗炎作用的实验研究[J]. 中国临床药理学与治疗学，2006，11(12)：1336.
[4] 丁媛媛. 桂皮醛对 CVB_3 诱发的小鼠病毒性心肌炎的作用机制研究[D]. 西安：第四军医大学，2008.
[5] 黄敬群，罗晓星，王四旺，等. 桂皮醛对抗血小板聚集和血栓形成的特点[J]. 中国临床康复，2006，31(10)：34.
[6] 李素民，杨秀岭，赵智，等. 干姜和生姜药理研究进展[J]. 中药材，1999，30(6)：471.
[7] Anurag Kuhad, Naveen Tirkey, Sangeeta Pilkrawa, et al. 6-Gingerol prevents cisplatin-induced acute renal failurein rats[J]. Bio Factors, 2006, 26(3): 189.
[8] Sue Ok Kim, Kyung-Soo Chun, Joydeb Kumar Kundu, et al. Effects of [6]-gingerol on PMA-induced COX-2 expression and activation of NF-κB and p38 MAPK in mouse skin[J]. Bio Factors, 2004, 21(1/4): 27.
[9] 杨军，余德顺，代明权. 超临界 CO_2 萃取不同部位姜油的组成研究[J]. 食品科学，2003，4(11)：79.
[10] 岳红坤，王娟，哇晓哲，等. 超临界 CO_2 流体萃取桂枝中桂皮醛的研究[J]. 石家庄学院报，2009，12(3)：140.
[11] 中国药典. 一部[S]. 2010：附录 XD：63.
[12] 施钧慧，汪聪慧. 香料质谱图集[M]. 北京：中国质谱学会，1992：118.

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analysis (^{1}H NMR, ^{13}C NMR and EIMS). **Result**: Seven compounds were obtained and identified as 3-*O*-α-*L*-arabinopyranosyl-28-*O*-α-*L*-rhamnopyranosyl-(1→4)-*O*-β-*D*-glucopyranosyl-(1→6)-*O*-β-*D*-glucopyranosyl ester of hederagenin (Ⅰ), kalopanaxsaponin Ⅰ (Ⅱ), 3-*O*-α-*L*-rhamnopyranosyl-(1→2)-*O*-α-*L*-arabinopyranoside-28-*O*-β-*D*-glucopyranosyl-(1→6)-*O*-β-*D*-glucopyranosyl ester of hederagenin (Ⅲ), kalopanaxsaponin B (Ⅳ), liriodendrin (Ⅴ), 2-methoxyhydroquinone 4-*O*-[6-*O*-(4-*O*-α-*L*-rhamnopyranosyl)-syringyl]-β-*D*-glucopyranoside (Ⅵ), syringin (Ⅶ). **Conclusion**: Compound Ⅰ, Ⅲ, Ⅴ, Ⅵ were obtained from this cdrus plant for the first time.

[**Key words**] *Kalopanax septemlobus*; chemical constituents; saponin

刺楸有悠久的药用历史,主要分布在我国东北山区、华北和西南部,其植株多刺,树皮可供药用,具有祛风利湿、解毒、活血、化痰止咳之功效,民间用于治疗风湿腰膝酸痛、神经痛、慢性支气管炎咳嗽、肾炎水肿等症。关于其化学成分研究虽有报道[1],但均不够系统深入。为进一步探讨刺楸树皮药理作用的物质基础,寻找先导化合物和活性有效部位,开发出药效显著的一,二类新药,本实验对东北产刺楸树皮的化学成分进行了系统研究,利用现代色谱技术,从刺楸树皮的乙醇提取物中分离得到 7 个化合物,其中化合物Ⅰ,Ⅲ,Ⅴ,Ⅵ为首次从本属植物中分得。

1 材料

Kofler 型显微熔点测定仪(温度计未经校正),JASCODIP-370 型数字旋光仪,FTSI-35 型傅立叶交换红外光谱仪(美国),Bruker AC-500 型核磁共振仪,ESI-FTICR MS 高分辨质谱仪,Finnigan Decaxp 质谱仪,岛津 LC-10AT,配以 ELSD 2000ES 蒸发光检测器及分流器,柱色谱硅胶(200 ~ 300,300 ~ 400 目),薄层色谱硅胶(青岛海洋化工厂),日本 YMC ODS C_{18}反相填料(北京金欧亚科技发展有限公司),ZTC 大孔树脂(天津南开大学化工厂)。

刺楸树皮于 2008 年 8 月采于吉林省集安县,经长春中医药大学邓明鲁教授鉴定为五加科植物刺楸 *Kalopnax septemlobus*(Thunb.)的干燥树皮。

2 方法与结果

2.1 提取与分离 取刺楸树皮 11 kg,粉碎后以 80% 乙醇回流提取 3 次,每次 2 h,合并提取液,滤过,减压浓缩得总浸膏,以蒸馏水制成悬浊液,依次用石油醚(60 ~ 90 ℃)、醋酸乙酯、水饱和正丁醇萃取,分别得到石油醚萃取物 30 g、醋酸乙酯萃取物 115 g 及正丁醇萃取物 165.5 g。将正丁醇萃取物以热水溶解,滤过,滤液加于已处理好的 D101 大孔吸附树脂上,分别以水、30% 乙醇、70% 乙醇、95% 乙醇洗脱,取 70% 乙醇及 30% 乙醇洗脱部分分别经过硅胶柱色谱分离、ODS 柱及高效液相色谱制备,从 70% 乙醇洗脱部分分离得到化合物Ⅳ(6 mg),Ⅰ(5 mg),Ⅱ(8 mg),Ⅲ(4 mg),从 30% 乙醇洗脱部分得到化合物Ⅴ(6 mg),Ⅵ(7 mg),Ⅶ(9 mg)。

2.2 结构鉴定 化合物Ⅰ 白色粉末,Liebermann-Burchard 反应及 Molish 反应均呈阳性,薄层色谱酸水解可检出阿拉伯糖、鼠李糖和葡萄糖;碱水解物中只检测到葡萄糖,提示该化合物 C-28 位的糖链上仅连有葡萄糖;^{1}H-NMR (400 MHz, pridine-d_5) δ: 1.42 m, 0.95 m (H-1), 2.02 m, 1.03 m (H-2), 4.16 m (H-3), 1.63 m (H-5), 1.55 m, 1.43 m (H-6), 1.71 m, 1.62 m (H-7), 1.62 m (H-9), 1.81 m, 1.76 m (H-11), 5.27 brs (H-12), 2.03 m, 0.98 m (H-15), 1.95 m, 1.89 m (H-16), 3.04 d 11.6, 4.0 (H-18), 1.59 m, 1.45 m (H-19), 1.18 m, 0.93 m (H-21), 1.55 m, 1.07 m (H-22), 4.18 m, 3.80 t 8.4 (H-23), 1.03 s (H-24), 0.86 s (H-25), 0.99 s (H-26), 1.06 s (H-28), 0.74 s (H-29), 0.76 s (H-30), 4.86 d 8.0 (ara-H-1), 4.06 m (ara-H-2), 3.90 m (ara-H-3), 4.19 m (ara-H-4), 4.18 m, 3.64 m (ara-H-5), 6.12 d 8.0 (glc-H-1), 4.03 m (glc-H-2), 4.05 m (glc-H-3), 4.81 m (glc-H-4), 4.29 m (glc-H-5), 4.55 m, 4.22 m (glc-H-6), 5.73 s (glc-H-1), 4.05 m (glc-H-2), 4.03 m (glc-H-3), 4.19 m (glc-H-4), 4.05 m (glc-H-5), 4.11 m, 4.01 m (glc-H-6)。^{13}C-NMR (100 MHz, pridine-d_5) δ: 39.0 (C-1), 26.2 (C-2), 82.1 (C-3), 43.6 (C-4), 47.8 (C-5), 18.3 (C-6), 32.9 (C-7), 40.1 (C-8), 48.3 (C-9), 37.1 (C-10), 23.5 (C-11), 123.1 (C-12), 144.2 (C-13), 42.3 (C-14), 28.4 (C-15), 24.0 (C-16), 47.2 (C-17), 41.8 (C-18),

46.3 (C-19), 30.9 (C-20), 34.1 (C-21), 33.2 (C-22), 64.6 (C-23), 13.7 (C-24), 16.3 (C-25), 17.7 (C-26), 26.2 (C-27), 176.7 (C-28), 33.2 (C-29), 23.8 (C-30)。3-glycosyl moiety, sugar arabinose, 106.8 (C-1), 73.3 (C-2), 74.9 (C-3), 69.8 (C-4), 67.1 (C-5); 28-*O*-sugar, glucose, 95.8 (C-1), 74.0 (C-2), 78.9 (C-3), 71.0(C-4), 78.2 (C-5), 69.4 (C-6); glucose, 105.0 (C-1), 75.5 (C-2), 76.7 (C-3), 78.4 C-4), 77.3 (C-5), 61.4 (C-6); rhamnose, 102.9 (C-1), 72.7 (C-2), 72.9 (C-3), 74.1 C-4), 70.4 (C-5), 18.7 (C-6)。根据文献分析[2],鉴定化合物为 3-*O*-*α*-*L*-阿拉伯糖-28-*O*-*α*-*L*-鼠李糖-(1→4)-*O*-*β*-*D*-葡萄糖-(1→6)-*O*-*β*-*D*-葡萄糖基-常春藤皂苷元酯。

化合物Ⅱ 白色无定形粉末, Liebermann-Burchard 反应阳性,Molish 反应阳性,薄层色谱酸水解物,与对照品对照,苷元鉴定为 hederagenin,单糖可检出阿拉伯糖、鼠李糖和木糖。^{1}H-NMR (400 MHz, pridine-d_5) δ: 1.42 m, 0.95 m (H-1), 2.02 m, 1.03 m(H-2), 4.16 m(H-3), 1.63 m (H-5), 1.55 m, 1.43 m(H-6), 1.71 m, 1.62 m(H-7), 1.62 m(H-9), 1.81 m, 1.76 m(H-11), 5.27 brs (H-12), 2.03 m, 0.98 m(H-15), 1.95 m, 1.89 m (H-16), 3.04 d 11.6, 4.0(H-18), 1.59 m, 1.45 m (H-19), 1.18 m, 0.93 m(H-21), 1.55 m, 1.07 m (H-22), 4.18 m, 3.80 t 8.4(H-23), 1.03 s(H-24), 0.86 s(H-25), 0.99 s(H-26), 1.06 s(H-28), 0.74 s(H-29), 0.76 s(H-30), 4.86 d 8.0 (ara-H-1), 4.06 m(ara-H-2), 3.90 m(ara-H-3), 4.19 m (ara-H-4), 4.18 m, 3.64 m(ara-H-5), 6.23 s (rha-H-1), 4.79 m(rha-H-2), 4.65 d 9.2(rha-H-3), 4.35 m(rha-H-4), 4.55 m(rha-H-5), 1.57 d 6.0 (rha-H-6), 5.23 d 7.6(xyl-H-1), 3.80 m(xyl-H-2), 4.05 m(xyl-H-3), 4.19 m(xyl-H-4), 4.22 m, 3.56 m(xyl-H-5)。^{13}C-NMR (100 MHz, pridine-d_5) δ:39.2 (C-1), 26.3 (C-2), 81.2 (C-3), 43.6 (C-4), 47.9 (C-5), 19.2 (C-6), 32.9 (C-7), 40.0 (C-8), 48.3 (C-9), 37.0 (C-10), 23.5 (C-11), 123.1 (C-12), 144.2 (C-13), 42.3 (C-14), 28.4 (C-15), 24.0 (C-16), 47.2 (C-17), 41.8 (C-18), 46.3 (C-19), 30.9 (C-20), 34.1 (C-21), 33.2 (C-22), 64.1 (C-23), 14.1 (C-24), 16.3 (C-25), 17.7 (C-26), 26.2 (C-27), 176.6 (C-28), 33.2 (C-29), 23.8 (C-30)。3-glycosyl moiety, sugar arabinose, 105.0 (C-1), 76.7 (C-2), 75.5 (C-3), 69.7 (C-4), 66.3 (C-5); rhamnose, 101.4 (C-1), 72.3 (C-2), 83.1 (C-3), 73.2 C-4), 69.9 (C-5), 18.7 (C-6); xylose, 107.0 (C-1), 75.6 (C-2), 74.8 (C-3), 74.3 (C-4), 64.5 (C-5)。经与文献[3]对照鉴定化合物Ⅱ为 kalopanaxsaponin I。

化合物Ⅲ 白色无定形粉末, Liebermann-Burchard 反应阳性,Molish 反应阳性,薄层色谱酸水解物,与对照品对照,苷元鉴定为 hederagenin,单糖可检出阿拉伯糖、鼠李糖和木糖。^{1}H-NMR (400 MHz, pridine-d_5) δ: 1.42 m, 0.95 m (H-1), 2.02 m, 1.03 m(H-2), 4.16 m(H-3), 1.63 m (H-5), 1.55 m, 1.43 m(H-6), 1.71 m, 1.62 m(H-7), 1.62 m(H-9), 1.81 m, 1.76 m(H-11), 5.27 brs (H-12), 2.03 m, 0.98 m(H-15), 1.95 m, 1.89 m (H-16), 3.04 d 11.6, 4.0(H-18), 1.59 m, 1.45 m (H-19), 1.18 m, 0.93 m(H-21), 1.55 m, 1.07 m (H-22), 4.18 m, 3.80 t 8.4(H-23), 1.03 s(H-24), 0.86 s(H-25), 0.99 s(H-26), 1.06 s(H-28), 0.74 s(H-29), 0.76 s(H-30), 4.86 d 8.0 (ara-H-1), 4.06 m(ara-H-2), 3.90 m(ara-H-3), 4.19 m (ara-H-4), 4.18 m, 3.64 m(ara-H-5), 6.23 s (rha-H-1), 4.79 m(rha-H-2), 4.65 d 9.2(rha-H-3), 4.35 m(rha-H-4), 4.55 m(rha-H-5), 1.57 d 6.0 (rha-H-6), 6.12 d 8.0 (glc-H-1), 4.03 m(glc-H-2), 4.05 m(glc-H-3), 4.81 m(glc-H-4), 4.29 m (glc-H-5), 4.55 m, 4.22 m(glc-H-6), 5.73 s(glc-H-1), 4.05 m(glc-H-2), 4.03 m(glc-H-3), 4.19 m (glc-H-4), 4.05 m(glc-H-5), 4.11 m, 4.01 m(glc-H-6)。^{13}C-NMR (100 MHz, pridine-d_5) δ:39.2 (C-1), 26.3 (C-2), 81.2 (C-3), 43.6 (C-4), 47.9 (C-5), 19.2 (C-6), 32.9 (C-7), 40.0 (C-8), 48.3 (C-9), 37.0 (C-10), 23.5 (C-11), 123.1 (C-12), 144.2 (C-13), 42.3 (C-14), 28.4 (C-15), 24.0 (C-16), 47.2 (C-17), 41.8 (C-18), 46.3 (C-19), 30.9 (C-20), 34.1 (C-21), 33.2 (C-22), 64.1 (C-23), 14.1 (C-24), 16.3 (C-25), 17.7 (C-26), 26.2 (C-27), 176.6 (C-28), 33.2 (C-29), 23.8 (C-30)。3-glycosyl moiety, sugar arabinose, 105.0 (C-1), 76.7 (C-2), 75.5 (C-3),

69.7 (C-4), 66.3 (C-5); rhamnose, 101.4 (C-1), 72.3 (C-2), 83.1 (C-3), 73.2 C-4), 69.9 (C-5), 18.7 (C-6); 28-*O*-sugar, glucose, 95.8 (C-1), 74.0 (C-2), 78.6 (C-3), 70.5 (C-4), 78.4 (C-5), 69.4 (C-6); glucose, 102.9 (C-1), 73.2 (C-2), 78.9 (C-3), 71.0 (C-4), 78.2 (C-5), 61.5 (C-6)。经与文献[4]对照鉴定化合物为 3-*O*-α-*L*-鼠李糖-(1→2)-*O*-α-*L*-阿拉伯糖-28-*O*-β-*D*-葡萄糖-(1→6)-*O*-β-*D*-葡萄糖常春藤皂苷元酯。

化合物Ⅳ　白色无定形粉末,mp 214 ~ 216 ℃ (MeOH), [α] 20D -19.0 (c = 0.24, MeOH), Liebermann-Burchard 反应及 Molish 反应均呈阳性,薄层色谱酸水解物,与对照品对照,苷元鉴定为 hederagenin,单糖可检出阿拉伯糖、鼠李糖和葡萄糖;^{1}H-NMR (400 MHz, pridine-d_5) δ: 1.42 m, 0.95 m (H-1), 2.02 m, 1.03 m(H-2), 4.16 m(H-3), 1.63 m (H-5), 1.55 m, 1.43 m(H-6), 1.71 m, 1.62 m(H-7), 1.62 m(H-9), 1.81 m, 1.76 m(H-11), 5.27 brs(H-12), 2.03 m, 0.98 m(H-15), 1.95 m, 1.89 m(H-16), 3.04 d 11.6, 4.0(H-18), 1.59 m, 1.45 m(H-19), 1.18 m, 0.93 m(H-21), 1.55 m, 1.07 m(H-22), 4.18 m, 3.80 t 8.4(H-23), 1.03 s(H-24), 0.86 s(H-25), 0.99 s(H-26), 1.06 s(H-28), 0.74 s(H-29), 0.76 s(H-30), 4.86 d 8.0 (ara-H-1), 4.06 m(ara-H-2), 3.90 m(ara-H-3), 4.19 m(ara-H-4), 4.18 m, 3.64 m(ara-H-5), 6.23 s (rha-H-1), 4.79 m(rha-H-2), 4.65 d 9.2 (rha-H-3), 4.35 m(rha-H-4), 4.55 m(rha-H-5), 1.57 d 6.0(rha-H-6), 6.12 d 8.0 (glc-H-1), 4.03 m(glc-H-2), 4.05 m(glc-H-3), 4.81 m(glc-H-4), 4.29 m(glc-H-5), 4.55 m, 4.22 m(glc-H-6), 5.73 s(glc-H-1), 4.05 m(glc-H-2), 4.03 m(glc-H-3), 4.19 m(glc-H-4), 4.05 m(glc-H-5), 4.11 m, 4.01 m(glc-H-6), 6.23 s (rha-H-1), 4.79 m(rha-H-2), 4.65 d 9.2(rha-H-3), 4.35 m(rha-H-4), 4.55 m (rha-H-5), 1.57 d 6.0(rha-H-6)。^{13}C-NMR (100 MHz, pridine-d_5) δ: 39.2 (C-1), 26.3 (C-2), 81.2 (C-3), 43.6 (C-4), 47.9 (C-5), 19.2 (C-6), 32.9 (C-7), 40.0 (C-8), 48.3 (C-9), 37.0 (C-10), 23.5 (C-11), 123.1 (C-12), 144.2 (C-13), 42.3 (C-14), 28.4 (C-15), 24.0 (C-16), 47.2 (C-17), 41.8 (C-18), 46.3 (C-19), 30.9 (C-20), 34.1 (C-21), 33.2 (C-22), 64.1 (C-23), 14.1 (C-24), 16.3 (C-25), 17.7 (C-26), 26.2 (C-27), 176.6 (C-28), 33.2 (C-29), 23.8 (C-30)。3-glycosyl moiety, sugar arabinose, 104.5 (C-1), 75.9 (C-2), 74.8 (C-3), 70.4 (C-4), 65.8 (C-5); rhamnose, 101.8 (C-1), 72.5 (C-2), 72.7 (C-3), 74.1 C-4), 69.5 (C-5), 18.7 (C-6); 28-*O*-sugar, glucose, 95.8 (C-1), 75.5 (C-2), 78.8 (C-3), 69.8 (C-4), 76.6 (C-5), 71.0 (C-6); glucose, 105.0 (C-1), 74.0 (C-2), 78.2 (C-3), 78.4 C-4), 77.3 (C-5), 61.4 (C-6); rhamnose, 102.9 (C-1), 72.7 (C-2), 72.9 (C-3), 74.3 (C-4), 69.4 (C-5), 18.7 (C-6)。经与文献对照鉴定化合物为 kalopanaxsaponin B。

化合物Ⅴ　白色无定形粉末(甲醇)。^{1}H-NMR (400 MHz, DMSO-d_6) δ: 6.66 (s, H-2′, H-2″, H-6′, H-6″), 4.94 (brs, glc-H-1′, glc-H-1″), 3.76 (OCH_3), 4.18 m (glc-H-2′, glc-H-2″), 4.29 m (glc-H-3′, glc-H-3″), 4.88 m(glc-H-4′, glc-H-4″), 4.67 m(glc-H-5′, glc-H-5″), 3.83 m (glc-H-6′, glc-H-6″), 3.60, 3.41 (m, H-4, H-8), 4.98 (m, H-2, H-6), 3.09, 3.02 (m, H-1, H-5)。^{13}C-NMR (100 MHz, DMSO-d_6) δ: 53.6 (C-1), 85.0 (C-2), 71.3 (C-4), 53.6 (C-5), 85.0 (C-6), 71.3 (C-8), 133.7 (C-1′, C-1″), 104.2 (C-2′, C-2″), 152.6 (C-3′, C-3″), 137.1 (C-4′, C-4″), 152.6 (C-5′, C-5″), 104.2 (C-6′, C-6″), 56.4 (OCH_3), 102.6 (glc-C-1′, glc-C-1″), 74.1 (glc-C-2′, glc-C-2″), 76.5 (glc-C-3′, glc-C-3″), 69.9 (glc-C-4′, glc-C-4″), 77.2(glc-C-5′, glc-C-5″), 60.9 (glc-C-6′, glc-C-6″)。以上数据与文献[5-6]对照分析,鉴定化合物为 liriodendrin(丁香树脂醇双葡萄糖苷)。

化合物Ⅵ　白色无定形粉末(甲醇)。^{1}H NMR (400 MHz, pridine-d_5) δ: 7.23 (2H, s), 7.02 (d, *J* = 1.6 Hz), 6.97 (d, *J* = 8.4 Hz), 6.57 (d, *J* = 7.2 Hz), 6.39 (d, *J* = 16.0 Hz), 6.19 (dt, *J* = 16.0, 5.2Hz), 5.39(1H, bs), 5.29(1H, bs), 5.22 (2H, bs), 4.97(1H, d, *J* = 7.2 Hz), 4.61(1H, d, *J* = 10.4 Hz), 4.25(1H, dd, *J* = 11.6, 7.6 Hz), 3.78(6H, s), 3.76(6H, s), 3.67(1H, dd, *J* = 4.8, 1.6), 3.28(2H, m), 1.07(d, *J* = 6 Hz)。^{13}C-NMR(100 MHz, pridine-d_5) δ: 131.0 (C-1), 109.9

(C-2), 148.9 (C-3), 145.7 (C-4), 114.9 (C-5), 118.5 (C-6), 129.1 (C-7), 128.1 (C-8), 61.5 (C-9), 55.6 (OCH_3); glucose, 99.9 (C-1), 73.1 (C-2), 76.6 (C-3), 70.4 (C-4), 73.8 (C-5), 64.4 (C-6); 125.2 (C-1), 106.6 (C-2), 152.9 (C-3), 138.4 (C-4), 152.9 (C-5), 106.6 (C-6), 165.0 (C-7), 56.1 (OCH_3); Rhamnose, 102.1 (C-1), 70.2 (C-2), 70.2 (C-3), 71.5 (C-4), 70.4 (C-5), 17.7 (C-6)。以上数据与文献报道的化合物[6]一致,鉴定化合物为 2-甲氧基对苯二酚 4-*O*-[6-*O*-(4-*O*-*α*-*L*-鼠李糖基)-紫丁香基]-*β*-*D*-吡喃葡萄糖。

化合物Ⅶ 无色晶体(甲醇), mp 197 ~ 199 ℃。^{1}H-NMR(400 MHz, pridine-d_5) δ: 6.73 (2H, s, H-2), 6.46 (d, J = 16.0 Hz, H-7), 6.32 (dt, J = 16.0, 5.2 Hz, H-8), 4.95(2H, m), 4.89(2H, m), 4.83(1H, t, J = 5.6 Hz), 4.26(1H, t, J = 7.2 Hz), 4.11(2H, br t, J = 4.4 Hz), 3.77(6H, s), 3.58 (1H, ddd, J = 4.8, 4.0, 1.6 Hz), 3.40(1H, q, J = 5.6 Hz), 3.19 (2H, m), 3.12 (1H, m), 3.00 (1H, m)。^{13}C-NMR(100 MHz, pridine-d_5) δ: 132.6 (C-1), 104.4 (C-2), 152.7 (C-3), 133.8 (C-4), 152.7 (C-5), 104.4 (C-6), 130.1 (C-7), 128.4 (C-8), 61.4 (C-9), 56.3 (OCH_3); glucose, 102.5 (C-1), 77.2 (C-2), 74.1 (C-3), 69.9 (C-4), 76.5 (C-5), 60.9 (C-6)。以上波谱数据与文献[6-7]一致,故鉴定化合物为 syringin(紫丁香苷)。

[参考文献]

[1] Grishkovets V I, Panov D A, Kachala V V, et al. Triterpene glycosides from *Kalopanax septemlobum*. 1. Glycosides A, B, C, F, G1, G2, I2, H, and ND J from leaves of *Kalopanax septemlobum* var. *maximowichii* introduced to crimea [J]. Chem Nat Com, 2005, 41(2), 194.

[2] Shao C J, Kasai R, Ohtani K, et al. Saponin from leaves of *Kalopanax septemlobus* (Thunb.) Koidz.. structures of kalopanax saponins La, Lb, Lc [J]. Chem Pharm Bull, 1989, 37(12): 3251.

[3] Panov D A, Grishkovets V I, Kachala V V, et al. Triterpene glycosides from *Kalopanax septemlobum*. VII. Minor glycosides from stems of *Kalopanax septemlobum* VAR. maximowiczii and *Kalopanax septemlobum* VAR. typicum [J]. Chem Nat Com, 2006, 42(1), 61.

[4] Shao C J, Kasai R, Xu J D. Saponin from roots of *Kalopanax septemlobus* (thunb) koidz., ciqiu: structure of kalopanax-saponins C, D, E and F [J]. Chem Pharm Bull, 1989, 37(2), 311.

[5] 吴婷,张晓琦,王英,等. 毛冬青根的化学成分研究[J]. 时珍国医国药, 2009, 20(12), 2923.

[6] Sano K, Sanada S, Ida Y, et al. Studies on the constituents of the bark of kalopanax pictus nakai [J]. Chem Pharm Bull, 1991, 39(4), 865.

[7] 达娃卓玛,周燕,白央,等. 绵头雪莲花的化学成分研究[J]. 中国中药杂志, 2008, 33(9), 1032.

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