苦红菇化学成分的研究（Ⅱ）△

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摘要 从苦红菇*Russula rosacea*的甲醇提取物中首次分得2个甾醇类化合物，经光谱分析分别鉴定为（22E，24S）-24-甲基-5α-胆甾-7，22-二烯-3β，5，6β-三醇〔（22E，24S）-24-methyl-5α-cholesta-7，22-diene-3β，5，6β-triol，Ⅰ〕和（22E，24S）-24-甲基-5α-胆甾-7，22-二烯-3β，5，6β，9-四醇〔（22E，24S）-24-methyl-5α-cholesta-7，22-diene-3β，5，6β-9-tetraol，Ⅱ〕。化合物Ⅱ有明显的体外抑制KB细胞的活性。

关键词 苦红菇 （22E，24S）-24-甲基-5α-胆甾-7，22-二烯-3β，5，6β-三醇 （22E,24S）-24-甲基-5α-胆甾-7，22-二烯-3β，5，6β，9-四醇 抗肿瘤活性 构效关系

前文[1]曾报道野生真菌苦红菇*Russula rosacea*（Bull）Grrayem Fr子实体甲醇提取物中2个新的三萜酸的分离和鉴定。本文报道其中多羟基甾醇的分离和鉴定，近年来，从海洋生物中分离多羟基甾醇化合物，尤其是具7,22 2个不饱和双键的甾醇的工作越来越受到广泛关注[2~4]，而迄今极少见到从真菌中分离得到该类甾醇的报道，药理筛选证明野生真菌苦红菇子实体酸性部分有抗肿瘤活性，因此，对这一部分进行了分离，从中得到2个甾醇化合物，经鉴定分别为（22E，24S）-24-甲基-5α-胆甾-7,22-二烯-3β，5,6β-三醇和(22E，24S）-24-甲基-5α-胆甾-7，22-二烯-3β，5，6β，9-四醇。这2个化合物从真菌中首次分离得到，其中Ⅱ有明显的体外抑制KB细胞的活性，而Ⅰ则没有活性。

比较Ⅰ和Ⅱ的结构，差别仅在于Ⅱ比Ⅰ多一个9-羟基，但却显示出显著的生物活性的差异，由此可见，9-羟基是产生抗肿瘤活性的重要官能团。这可能是由于9-羟基改变了分子的电荷分布而使其与药物受体有更好的亲和性的结果。因此，值得进一步研究。

1 仪器和试剂

熔点用PHMK79/2195显微熔点测定仪测定，温度计未校正；红外光谱仪为Perkin-Elmer-580B型，KBr压片；质谱仪为MAT-711/200型；核磁共振用Brucker-AM-500仪测定，以TMS为内标。柱层析，薄层层析硅胶均系青岛海洋化工厂生产。

2 提取和分离

3.2kg苦红菇粗粉用甲醇回流提取3次，减压回收甲醇，得甲醇提取物450g，用乙酸乙酯萃取，得浸膏106.5g，再以乙醚溶解，加5％NaOH水溶液搅拌，得碱液。碱液以盐酸酸化至pH2，再以乙醚萃取，水洗醚液至中性并干燥过滤后浓缩得到酸性部分17.4g，取其中11g，以500g硅胶装柱，用氯仿-甲醇梯度洗脱，从氯仿-甲醇（96：6）洗脱部分得Ⅰ和Ⅱ的粗品，再经低压柱层析进一步纯化，用甲醇重结晶，分别得纯品Ⅰ和Ⅱ。

3 鉴定

化合物Ⅰ：无色针晶，$C_{28}H_{46}O_3$，MSm/z：412（M^+-H_2O），397（M^+-H_2O-CH_3），394（M^+-$2H_2O$），379（M^+-$2H_2O$-CH_3），287，269，251，227，197，81，

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69, 55, 43, 41, , ^{1}HNMR (C_5D_5N, δ): 5.65 (1H, dd, J = 4.8, 2.2Hz, C_7-H,) 5.27 (1H, dd, J = 14.8, 6.9Hz, C_{22}-H), 5.20 (1H, dd, J = 14.8,8,1Hz, C_{23}-H), 4.70 (1H, m, $C_{3\alpha}$-H), 4.20 (1H, br.s, $C_{6\alpha}$-H), 2.90 (1H, t, J = 12.8Hz, C_4-H_{ax}), 2.40 (1H, dd, J = 12.8, 4.9Hz, C_4-H_{eq}), 1.46 (3H, s, C_{19}-Me), 1.06 (3H, d, J = 6.6Hz, C_{21}-Me), 0.96 (3H, d, J = 6.8Hz, C_{28}-Me), 0.88 (3H, d, J = 4.9Hz, C_{27}-Me), 0.86 (3H, d, J = 4.9Hz, C_{26}-Me), 0.65 (3H, s, C_{18}-Me). ^{13}CNMR (C_5D_5N, δ): 32.6 (C_1), 33.9 (C_2), 67.6 (C_3), 41.8 (C_4), 76.1 (C_5), 74.2 (C_6), 120.4 (C_7), 141.6 (C_8), 43.8 (C_9), 38.1 (C_{10}), 22.5 (C_{11}), 40.0 (C_{12}), 43.9 (C_{13}), 55.2 (C_{14}), 23.5 (C_{15}), 28.4 (C_{16}), 56.4 (C_{17}), 12.6(C_{18}), 18.8 (C_{19}), 40.8 (C_{20}), 21.5 (C_{21}), 136.2 (C_{22}), 132.3 (C_{23}), 43.2 (C_{24}), 33.4 (C_{25}), 19.9 (C_{26}), 20.2 (C_{27}), 17.9 (C_{28})。以上数据与文献基本一致[5]。

化合物Ⅱ：无色针晶，$C_{28}H_{46}O_4$，mp：252～254℃，IR (KBr)cm^{-1}：3400～3300，2960，2880，1450，1050，1000，970。MSm/z：428 (M^+-H_2O)，410 (M^+-$2H_2O$) 395 (M^+-$2H_2O$-Me)，382 (M^+-$3H_2O$)，367，251，69，55，43。^{1}HNMR (C_5D_5N, δ)：6.07 (1H, br.s, C_7-H), 5.28 (1H, dd, J = 14.6, 7.9Hz, C_{23}-H), 5.22(1H, dd, J = 14.6, 6.7Hz, C_{22}-H), 4.75 (1H, m, $C_{3\alpha}$-H), 4.37 (1H, br.d, J = 2.3 Hz, $C_{6\alpha}$-H), 1.57 (3H, s, C_{19}-Me), 1.07 (3H, d, J = 6.6Hz, C_{21}-Me), 0.96 (3H, d, J = 6.9Hz, C_{28}-Me), 0.88 (3H, d, J = 6.7Hz, C_{27}-Me), 0.86 (3H, d, J = 6.7Hz, C_{26}-Me), 0.80 (3H, s, C_{18}-Me)。^{13}CNMR (C_5D_5N, δ)：28.5 (C_1), 32.5 (C_2), 67.3 (C_3), 42.0 (C_4), 75.0 (C_5), 73.9 (C_6), 121.3(C_7), 143.1(C_8), 78.7 (C_9), 41.4 (C_{10}), 29.2 (C_{11}), 36.0 (C_{12}), 44.3 (C_{13}), 51.3 (C_{14}), 23.5 (C_{15}), 28.2 (C_{16}), 56.4 (C_{17}), 12.1 (C_{18}), 22.4 (C_{19}), 40.7(C_{20}), 21.4(C_{21}), 136.2 (C_{22}), 132.2 (C_{24}), 33.4 (C_{25}), 19.9 (C_{26}), 20.2 (C_{27}), 17.9 (C_{28}). 以上数据与文献基本一致[6]。

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ABSTRACTS OF ORIGINAL ARTICLES

Stndies on the Chemical Constituents of the Leaves of Chinese Aloe (*Aloe vera* var *Chinensis*)

Yuan Axing, Kang Shuhua, Qin Ling, et al

Four compounds isolated from the leaves of *Aloe vera* L. var. *Chinensis* (Haw.) Berg. in the province of Guangxi have been identified. One of them was a new natural product, namely iso-aloesin, whose structure was established as 2-acetonyl-6-C-β-D-glucopyranosyl-7-hydroxy-5-methyl-chromone. The other three were aloe-emodin, aloesin and 2,5-dimethyl-8-C-β-D-glucopyranosyl-7-hydroxy-chromone.

(Original article on page 339)

Studies on the Chemical Constituents of Kuhonggu (*Russula rosacea*)(I)

Wang Huaibin, Xu Weishen, et al

Two sterols were isolated from the methanolic extract of the fungus, *Russula rosacea* (Bull) Grray em. Fr. for the first time. They were identified respectively as (22E, 24S)-24-mehyl-5α-cholesta-7,22-diene-3β, 5, 6β-triol (I) and (22E, 24S)-24-methyl-5α-cholesta-7, 22-diene-3β, 5, 6β, 9-tetraol (II) by spectral analysis. II exhibits high antitumor activity in vitro.

(Original article on page 342)

Studies on the Chemical Constituents of the Stems and Leaves of Thunberg Fritillary (*Fritillaria thunbergii*)

Yan Mingming, Jin Xiangqun, Xu Dongming

Six compounds, syringaresinol (I), 2,5-dimethoxy-1,4-benzoquinone (II), β-sitosterol (III), verticine (IV), verticinone (V) and solanidine (VI) were isolated from the aerial parts of *Fritillaria thunbergii* Miq. Their structures were determined by spectral data and chemical evidences. I and II were obtained from the *Fritillaria* L. for the first time.

(Original article on page 344)

Comparative Analysis on the Quality Between Regenerated Bark of Eucommia (*Eucommia ulmoides*) and Primitive Bark

Meng Qin, Wu Xiaolin, Cao Guihua

The characteristic feature, tissue structure and chemical composition of primitive bark and one to four years regenerated bark of *Eucommia ulmoides* were compared, and the contents of elastic rubber thread, chlorogenic acid and ethanolic extract of the two barks were determined. Results showed that regenerated bark is of the same quality as primitive bark.

(Original article on page 350)