*Chemistry of Natural Compounds, Vol. 35, No. 6, 1999*

# TRITERPENE GLYCOSIDES FROM *Hedera scotica* LEAVES

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UDC 547.918

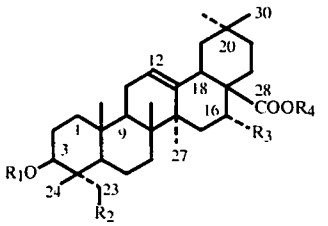
Scottish ivy *Hedera scotica* A. Cheval. [synonyms *H. helix* var. hibernica (Kirchn.) Rehd., *H. helix* hibernica hort. ex Kirchn., *H. helix* var. scotica hort.] grows wild in Ireland and possibly in Scotland [1]. It is also widely cultivated as a decorative plant. It differs from common ivy (*H. helix* L.) in having larger and wider leaves and other morphological features. This provided a basis to classify it as a separate species. However, all taxonomic features that indicate it is only a variety of *H. helix* have not been considered.

Until now the glycoside composition of Scottish ivy has not been studied. Preliminary TLC analysis of the alcohol extract of *H. scotica* leaves obtained from the Botanical Garden of the Academy of Sciences Institute of Botany (St. Petersburg) showed that they contain a significant amount of triterpene glycosides. The qualitative composition was identical to that of *H. helix* [2] and *H. taurica* [3] leaves.

Triterpene glycosides from *H. scotica* leaves were isolated and separated chromatographically as described before [2]. The following compounds were obtained and identified with known glycosides [2]: 3-O-α-*L*-arabinopyranosides of oleanolic (**1**, 0.01%) and echinocystic (**2**, 0.02%) acids and hederagenin (**3**, 0.05%); 3-O-α-*L*-rhamnopyranosyl-(1→2)-O-α-*L*-arabinopyranosides of oleanolic (**4**, 0.05%), and echinocystic (**5**, 0.15%) acids and hederagenin (**6**, 2.0%); 3-sulfates of oleanolic (**7**, 0.2%) and echinocystic (**8**, 0.03%) acids; and the 28-O-α-*L*-rhamnopyranosyl-(1→4)-O-β-*D*-glucopyranosyl-(1→6)-O-β-*D*-glucopyranosyl esters of **1** (**9**, 0.01%), **2** (**10**, 0.02%), **3** (**11**, 0.1%), **4** (**12**, 0.1%), **5** (**13**, 0.2%), **6** (**14**, 2.3%), **7** (**15**, 0.25%), and **8** (**16**, 0.05%).

Leaves of *H. scotica* (and *H. taurica*) have an elevated content of the 3-sulfates of oleanolic and echinocystic acids and their 28-O-glycosides compared quantitatively with the glycoside composition of *H. helix* leaves (western Ukraine near L'vov). Our data indicate that *H. scotica*, *H. taurica*, and *H. helix* are surely related and confirm that they belong to *Helix* Pojark. [1]. However, the macroscopic morphology of *H. scotica* resembles that of Canary ivy *H. canariensis* Willd. Thus, certain researchers consider *H. scotica* to be a variety of the this species (Seeman) or a hybrid with *H. helix* (Schneider) [1].

However, the glycoside composition of *H. scotica* from a chemotaxonomic viewpoint is qualitatively different from that of *H. canariensis* [4-6]. Thus, despite the presence of common principal glycosides **6** and **14**, **1-5**, and **9-13**, the 3-sulfates of oleanolic and echinocystic acids and their 28-O-glycosides are not found in *H. canariensis*. On the other hand, we did not find in *H. scotica* glycosides of 30-norhederagenin [5] and glycosides with acetate groups [6], which are present in *H. canariensis*. This obviously differentiates *H. scotica* and *H. canariensis* but enables the former to be viewed as a subspecies (variety) of *H. helix*.

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Simferopol State University. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 809-810, November-December, 1999. Original article submitted July 30, 1999.

 0009-3130/99/3506-0690$22.00 

| | $R_1$ | $R_2$ | $R_3$ | $R_4$ |
|---|---|---|---|---|
| **1** | $Ara_p\alpha$- | H | H | H |
| **2** | $Ara_p\alpha$- | H | OH | H |
| **3** | $Ara_p\alpha$- | OH | H | H |
| **4** | $Rha_p\alpha$-(1-2)-$Ara_p\alpha$- | H | H | H |
| **5** | $Rha_p\alpha$-(1-2)-$Ara_p\alpha$- | H | OH | H |
| **6** | $Rha_p\alpha$-(1-2)-$Ara_p\alpha$- | OH | H | H |
| **7** | $^-O_3S$- | H | H | |
| **8** | $^-O_3S$- | H | OH | |
| **9** | $Ara_p\alpha$- | H | H | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **10** | $Ara_p\alpha$- | H | OH | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **11** | $Ara_p\alpha$- | OH | H | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **12** | $Rha_p\alpha$-(1-2)-$Ara_p\alpha$- | H | H | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **13** | $Rha_p\alpha$-(1-2)-$Ara_p\alpha$- | H | OH | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **14** | $Rha_p\alpha$-(1-2)-$Ara_p\alpha$ | OH | H | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **15** | $^-O_3S$- | H | H | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |
| **16** | $^-O_3S$- | H | OH | -$\beta Glc_p$-(6-1)-$\beta Glc_p$-(4-1)-$\alpha Rha_p$ |

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