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Sesquiterpene lactones and monoterpene glucosides from plant species *Picris echoides*

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Investigation of the constituents of the aerial parts of domestic plant species *Picris echoides* afforded the sesquiterpene lactones, *i.e.,* guaianolides jacquilenin (**1**), 11-*epi*-jacquilenin (**2**), achillin (**3**) and eudesmanolide telekin (**4**). The chemical indentification of the two monoterpene glucosides (–)-*cis*-chrysanthenol-β-D-glucopyranoside (**5**) and its 6'-acetate **6** is also repoted. The guaianolide achillin (**3**) and the two monoterpene glucosides **5** and **6** were isolated for the first time from this plant species. Isolation was achieved by column chromatography and the structures were established mainly by the interpretation of their physical and spectral data, which were in agreement with those in the literature.

Keywords: *Picris echoides*, *Lactuceae*, sesquiterpene lactones, monoterpene glucosides.

INTRODUCTION

The small genus *Helminthia* from the tribe *Lactuceae* (family *Asteraceae*), comprising 6 species is a native floral element, as the widespread weed of the central Europe and Mediterranean region. In Serbia only one species grows (*H. echoides*), which has extensive name as syn. *Picris echoiles* L.[1] This species can be found throughout the world, *i.e.,* southern Asia and also in the North America, where it is a major weed problem. As far as traditional medicine is concerned, *Picris echoides* has been used as alcoholic extract for the treatment of indigestion and against intestinal nematodes and other parasites.[1]

As a result of the numerous biological activities, secondary metabolites of the members of this genus have received considerable attention.[2] As far as the biological activity is concerned, among the most interesting compounds isolated from these species are: sesquiterpene lactones, flavonoids and terpenoid glycosides (mainly in the aerial parts).[3–6] Hitherto, several sesquiterpenes and sesquiterpene lactones, almost

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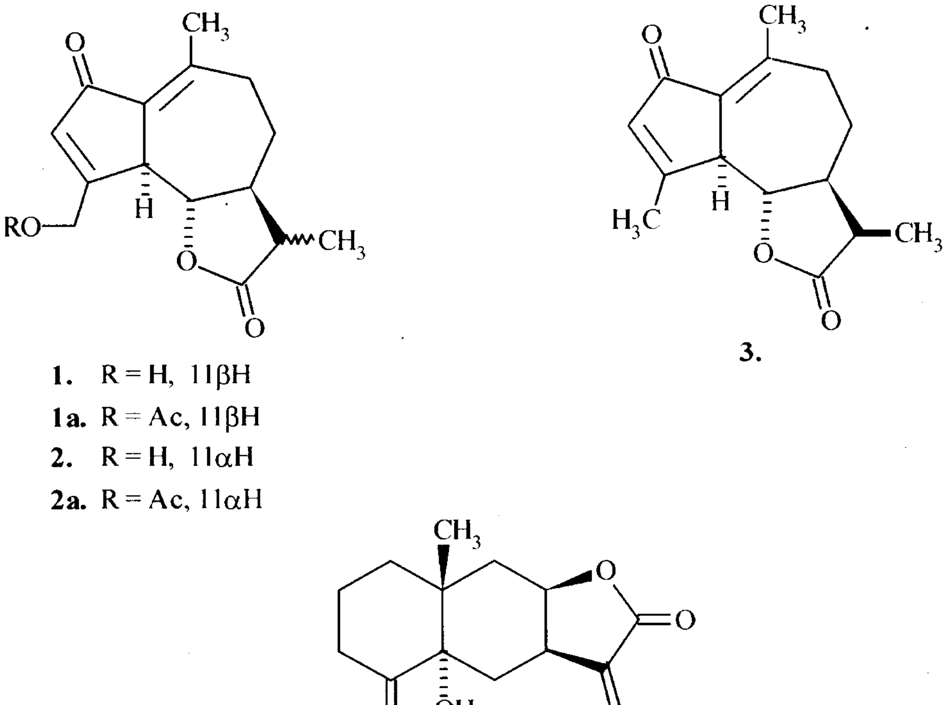
[#] Serbian Chemical Society active member highly oxygenated germacranolides, were isolated from the aerial parts of *P. echoides.*[7,8] We have recently reported the contents of this species in flavonoid and terpenoid compounds.[9,10] In view of the marked and interesting biological and medicinal properties of these metabolites, we have undertaken an investigation on the presence of the sesquiterpene lactones in the domestic plant species and to determine the relationships to other genera of the tribe *Lactuceae*.

RESULTS AND DISCUSSION

In this paper we report our investigation of the sesquiterpene lactones and terpenes composition of the domestic plant species *P. echoides*, originating from Mt. Rudnik. The extract of the aerial parts was prepared by the usual procedure for the isolation of sesquiterpene lactones.[11] Silica gel column chromatography of the extract afforded four sesquiterpene lactones (Scheme 1, **1–4**). They were identified by comparison of their spectral data to those published. The guaianolides, jacquilenin (**1**) and its C-11 epimer **2**, are typical for this tribe.[7,8,12]



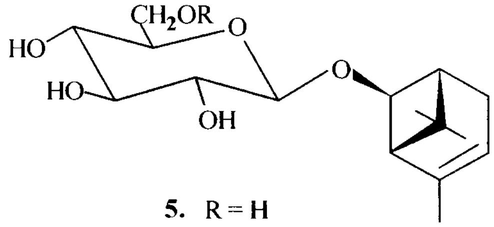
1. R = H, 11βH
1a. R = Ac, 11βH
2. R = H, 11αH
2a. R = Ac, 11αH

3.

4.

Scheme 1. Sesquiterpene lactones from the plant species *Picris echoides*.

However, compounds **1** and **2** could only be separated and identified as their acetates **1a** and **2a**, respectively. Lactone **1** is a clearly positional isomer of **2**, as regards the



5. R = H
6. R = Ac

Scheme 2. Monoterpene glucosides from the *Picris echoides*.

location of the methyl group. This assignment was based on a comparison of the ^{1}H- and ^{13}C-NMR of **1a** and **2a** mostly differing in the chemical shifts of the C(11)-H moiety, *i.e.,* H-11: δ 2.35, 2.37 (**1a**)/ δ 2.65, 2.61 (**2a**) and C-11: δ 39.27 (**1a**)/ δ 39.56 (**2a**), which is in accordance with the published data concerning **1** and **2**.[8] The chemical shifts of the C (H)-13 as doublet at 1.15 ppm for 3H, with the coupling constant $J_{7,11}$ = 7.58 Hz and in ^{13}C-δ for C-11 at 39.25 and for C-13 at 9.95, also indicated the presence of 11β-methyl group in the lactone **2**. The structures of the lactones **1** and **2** were also easily deduced from the similarities of their spectral data to those of lactone **3**.

Our investigation of *P. echoides* also points out the absence of the known quaianolides isolated from this plant species namely hieracin I, hieracin II and 8-deoxylactucin.[8] On the contrary, we have isolated and identified the guaianolide achillin (**3**), which have not been isolated so far from this plant species. Lactone **3**, originally was isolated from the plant species *Artemisia lanata*,[13] for the first time and later from *Achillea depressa*, whose structure was revised and confirmed.[14] Comparison of the physical and spectral data of lactone **3**, (MS, UV, IR and NMR) are in a good agreement with already reported values.[14]

Eudesmanolide telekin (**4**) was also isolated and elucidated in the domestic plant species *P. echoides*. Lactone **4** was previously reported as the plant constituent in this material[7] and was found for the first time as the main eudesmanolide in the plant species of the *Telekia speciosa*.[15] A comparison of the spectral data to that reporeted, lactone **4** was identified.

In addition to the sesquiterpene lactones, two known monoterpene glucosides, (–)-*cis*-chrysanthenol-β-D-glucopyranoside (**5**) and its 6'-acetate **6** (Scheme 2) were isolated for the first time from *Picris echoides*. Compound **5** exhibited ^{1}H- and ^{13}C-NMR spectral data almost identical to those published.[16] When compound **5** was subjected to the hydrolysis (see Experimental) it gave D-glocose and aglycone part identified as (–)-*cis*-chrysanthenol, a compound isolated almost 30 years ago from *Dicoria canescens*.[17] The structure of the compound **6** was easily deduced from the similarities of the spectral data to those of **5**. As regard of **6**, this spectral data clearly indicate the monoacetate, at C-6' position at glucose part of **5**. A few years ago monoterpene glucoside **6**, was isolated for the first time from *Artemisia sieberi*.[18] However the concentrations are very low and therefore the presence of these compounds may have been overlooked in several cases.

The results obtained from this investigation assigned the lactucin- like sesquiterpenes (C(15)-OH guaian) may be the characteristic at least for some groups of the tribe *Lactuceae*. Furthermore, the presence of 11,13-dihydro compounds seems to be typical. So, the chemical picture of the domestic plant species of *Picris echoides*, which can be drawn from these results, is expected from the chemotaxonomic point of view of this tribe.[8] Monoterpene glucosides are not usual in the genus either.

EXPERIMENTAL

Plant material

Aerial parts of *Picris echoides L.* has traditional name Grgusa (family *Asteraceae*, tribe *Lactuceae*)[1,19] were collected in the vicinity of Mt. Rudnik in July 1995 and 1996 and authenticated by Dr. P. Marin, from the Department of Botany at the Faculty of Biology, University of Belgrade. A voucher specimen has been deposited in the herbarium of this Department.

Extraction and isolation

Air-dried, finely ground aerial parts of *P. echoides* (2.5 kg) were extracted for 48 h at room temperature with petrol-Et_2O-MeOH, 1:1:1 (10 liters). After concentration at reduced pressure in a rotary evaporator, the residue was dissolved in boiling MeOH (1 liter) and cooled to the room temperature. The supernatant liquid was decanted from the waxy precipitate and then concentrated *in vacuo,* giving 32 g of dark greenish oil as residue. This residue was prefractionated by column chromatography on silica gel. The three fractions were collected after elution with solvents: petrol-Et_2O, 1:3, **A**; Et_2O, **B** and finally with Et_2O-MeOH, 6:1, fraction **C**. The fractions **A**, **B** and **C** were subjected for further repeated CC on silica gel, respectively.

Fraction **A** (18 g) contained mainly the pigments, waxes and wide spread sterols. Elution was begun with petrol-Et_2O, 9:1 and then gradually increasing the polarity by addition of Et_2O, giving the lactone **3** with petrol-Et_2O (8 mg, recrystallysed from hexane-ether). It was isolated as colorless needles, melted at 133–134 ºC and $[\alpha]_D = +115$ (*c*, 1, $CHCl_3$), same as the literature,[14] EIMS, *m/z* (rel. int. %):246 (M^+, 47), 231 (6), 217 (23), 203 (25), 190 (15), 91 (100) and the other spectral data corresponded to those published. The polar fraction **B** (5.2 g), contained the material eluted with Et_2O, previously, was furter submitted to CC, starting with petrol-Et_2O (1:1). The two main fractions were selected after the inspection by NMR and in the next step fractionated by HPLC (RP-18, MeOH-H_2O, 3:2, *ca* 150 bar), respectively. The first fraction could not be separated by HPLC containing mixture of the epimers **1** and **2**. Acetylation (Ac_2O, 2 h, 70 ºC) it gave the acetates, which were separated by silica gel CC, with petrol-Et_2O (2:1) affording the **1a**, with $[\alpha]_D = +105$ º (*c*, 0.7, $CHCl_3$) (12 mg) and **2a**, with $[\alpha]_D = +44$ º (*c*, 0.1 $CHCl_3$) (8 mg), as colorless gummy materials. Their IR, NMR and MS data corresponded to those published. The second fraction, after separation by HPLC yielded lactone telekin (**4**, 13 mg), as the white crystals.

The more polar fraction **C** (2.5 g) was separated by silica gel CC (Et_2O-MeOH, 7:1) yielding the (–)-*cis*-chrysanthenol-β-D-glucopyranoside (**5**, 18 mg), gum with $[\alpha]_D = -44$ º (*c*, 0.8, MeOH); IR (ν_{max} cm^{-1}): 3400, 1368, 1210, 1070, 1040, 1025, 760. EIMS *m/z* (rel. int.): 296.1624 $(M-H_2O)^+$ (8), 268 (4), 192 (8), 190 (20), 175 (16), 149 (22), 134 (33), 119 (82), 93 (59), 91 (100), 55 (67). Calc. for $C_{16}H_{26}O_6$-H_2O, M^+, 296.1618. The compound **5** (10 mg) was dissolved in 10 ml of methanol and 20 ml of 6 % HCl was added. The solution was heated on a water bath for 45 min, cooled and extrcted several times with water. The solvent was removed *in vacuo* and the remaining substance identified as (–)-*cis*-chrysanthenol and glucose was also detected in the water solution.[16] Elution with Et_2O-MeOH, 7:1 as solvent mixture also afforded (–)-*cis*-chrsanthenol-β-D-glucopyranoside-6'-acetate (**6**, 11 mg), gum with $[\alpha]_D = -126$ º (*c*, 0.5, MeOH); IR (ν_{max} cm^{-1}): 3400, 1725, 1436, 1365, 1250, 1215, 1080, 1030, 750. EIMS *m/z* (rel. int): 296.1624 $(M-HOAc)^+$ (20), 192 (38), 190 (29), 175 (42), 149 (90), 134 (38), 119 (100), 107 (48), 105 (31), 93 (55), 91 (80). Calc. for

$C_{18}H_{28}O_7$-HOAc, M^+, 296.1618. NMR ^{13}C- and ^1H- spectral data corresponded to those published.[18]

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ИЗВОД

СЕСКВИТЕРПЕНСКИ ЛАКТОНИ И МОНОТЕРПЕНСКИ ГЛУКОЗИДИ БИЉНЕ ВРСТЕ *Picris echoides* L.

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Из надземног дела домаће биљне врсте *Picris echoides* (фамилија *Asteraceae*), корова познатог под именом Гргуша, изолована су и идентификована четири сесквитерпенска лактона, као и два монотерпенска глукозида. Идентификовани лактони су гвајанолиди јаквиленин (**1**), 11-*epi*-јаквиленин (**2**) и ахилин (**3**) као и еудесманолид телекин (**4**). Монотерпенски глукозиди (–)-*cis*-кризантенол-b-D-глукопиранозид (**5**) и његов 6´-ацетат, **6** су такође изоловани из истог екстракта. Гвајанолид ахилин (**3**) и монотерпенски глукозиди (**5**,**6**) су по први пут изоловани из ове биљне врсте, док су преостала три лактона изолована више пута из европске биљне врсте.

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