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Isolation of Monotropein, an iridoid glucoside from Arbutus unedo

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SEZIONE II

(Fisica, chimica, geologia, paleontologia e mineralogia)

Chimica organica. — *Isolation of Monotropein, an iridoid glucoside from* Arbutus unedo. Nota di PAOLA ESPOSITO (*) e MARCELLO NICOLETTI (**), presentata (***) dal Corrisp. G. B. MARINI-BETTÒLO.

RIASSUNTO. — Dalle foglie di *Arbutus unedo* (Ericaceae) è stato isolato un glucoside iridoide, la monotropeina *1*, identificata in base ai dati spettroscopici dello stesso iridoide e dei suoi derivati. Viene inoltre riportato l'uso di $LiAlH_4$ quale agente riducente stereospecifico di anelli epossidici in glucosidi iridoidi.

In this paper we report the isolation and identification of an iridoid glucoside, *1*, isolated from the leaves of *Arbutus unedo* (Ericaceae). In the same plant another iridoid glucoside, unedoside *2*, containing an epoxidic ring is present [1].

1 is a crystalline compound (m.p. 163–5 °C, from $MeOH-H_2O$) showing acidic properties it has a molecular formula $C_{16}H_{22}O_{11}$ and Rf 0.21 (bluish-violet spot with vanillin reagent). *1* shows UV absorption at 235 nm ($\lg \varepsilon = 3.9$), characteristic of an iridoidic enol-ether system, conjugated with a carbonyl group [2], IR bands at 1700 and 1650 cm^{-1} and in the mass spectrum peaks at m/e 359 ($M^{+}-31$) and 331 ($M^{+}-59$) are present. Like other naturally occurring iridoid glucosides, *1* is converted by acid hydrolysis into glucose (1 mole) and insoluble black products, due to the decomposition of the aglycone.

The ^1H NMR spectrum of *1* in D_2O confirms the iridoid structure and, in particular, shows: a doublet at δ 7.39 (J = 1.0 Hz), attributable to H–3, shifted to lower fields by the presence of the carbonyl group at C (4), in accordance with previous UV and IR data; two double doublets at δ 6.21 (J = 6.0 and 2.4 Hz) and 5.68 (J = 6.0 and 1.8 Hz), attributable to two vicinal olefinic protons in the cyclopentane ring; a doublet at δ 5.60 (J = 2.0 Hz), assignable to H–1; a double doublet at δ 2.66 (J = 8.0 and 2.0 Hz) due to H–9.

Acetylation of *1* under mild conditions afforded the pentaacetate *3* ($C_{26}H_{32}O_{16}$), m.p. 176–8 °C, which shows in the IR spectrum a residual OH band, which could be attributed to a tertiary hydroxyl group The ^1H NMR spectrum of *3* ($CDCl_3$), in addition to the signals analogous to the corresponding ones in *1*, evidences the presence of five acetoxy groups (four belonging to the glucose and one to the aglycone).

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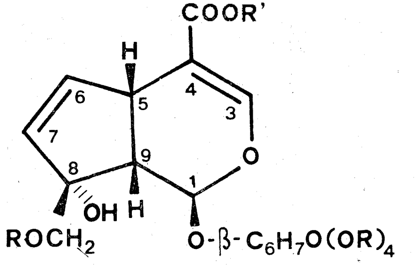
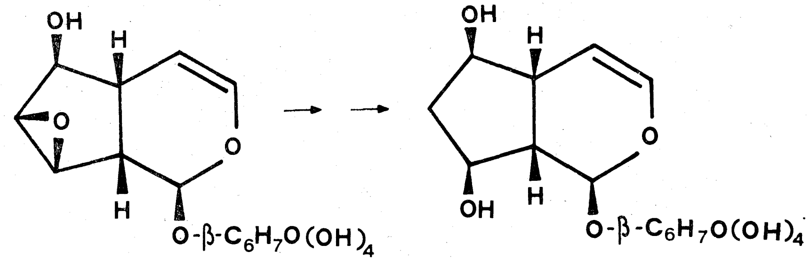
(***) Nella seduta del 12 gennaio 1980.

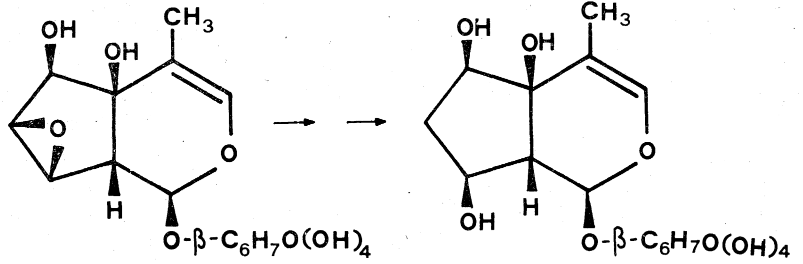


	R	R'
1	H	H
3	COCH$_3$	H
4	H	CH$_3$



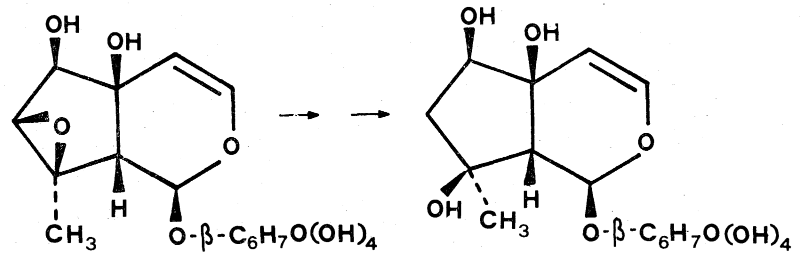
2 Unedoside

6



5 Scabroside

7



8 Antirrhinoside

9 Harpagide

Finally *1* was converted by reaction with CH_2N_2 into the methylester derivative *4*, which shows in the ^{1}H NMR spectrum (D_2O) the appearance of the signal at δ 3.70, correspondent to the carbomethoxy group. Spectroscopic evidences were corroborated by detailed spin decoupling experiments carried out on compound *4* (in methanol-d_4). In fact the irradiation at δ 3.8, multiplet relative to H–5, partially masked by glucose signals, converted the double doublets H–6, H–7 and H–9 into doublets (J = 6.0, 6.0 and 2.0 Hz, respectively); irradiation of the doublet at δ 5.58 (H–1) simplified the double doublet assigned to H–9 into a doublet (J = 8.0 Hz); finally irradiation at δ 2.70 (H–9) transformed H–1 into a sharp singlet and generated some changes into the overlapped zone between δ 3.6–4.0.

Spectroscopical and physical data of 1 are in agreement with those reported for monotropein [4].

In other plants [5] compounds having C (7, 8) β-epoxide function are coupled with compounds having C (8) β-hydroxyl function. Usually these substances have been chemically correlated by reductive cleavage of the epoxide function with Li in liquid NH_3 [5]. Disadvantages of this reaction are the low temperature (— 70 °C) and the difficulty in obtaining a good medium for the reaction.

We investigated an alternative and more convenient method. Good results were obtained using $LiAlH_4$ on the O-acetyl derivatives in THF at 25 °C for 2.5 h. The reaction was achieved on unedoside *2* and scabroside *5* obtaining as the only product the corresponding C (8) β-hydroxyl iridoid compounds *6* and *7* respectively. Similarly antirrhinoside *8* gave harpagide *9*, but to raise the yield of the reaction it was necessary to operate at 70 °C, in accordance with the lower reactivity of substituted epoxide function [6].

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