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SESQUITERPENE LACTONES OF *Artemisia absinthium*

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Two sesquiterpene lactones have been isolated from the epigeal part of Artemisia absinthium. *On the basis of chemical transformations and spectral characteristics it has been established that one of them is identical with artabin, while the other has the structure of 3β,8α-dihydroxy-5βH,6βH,7αH,8βH-guai-4(15)-en-6,12-olide.*

Two substances have been isolated from common wormwood, *Artemisia absinthium*, gathered in the Kusary region of the Azerbaidzhan Republic in July, 1995: **(1)** — $C_{15}H_{22}O_3$, mp 161-163°C (chloroform–petroleum ether); and **(2)** — $C_{15}H_{22}O_4$, mp 124-125°C (chloroform–petroleum ether).

The IR spectrum of substance (1) showed absorption bands at (cm^{-1}) 3500 (OH group), 1765 (CO of a γ-lactone ring) and 1672 (double bonds). The acetylation of substance (1) led to a monoacetate with the composition $C_{17}H_{24}O_4$, mp 170-172°C, the IR spectrum of which contained bands at (cm^{-1}) 1770 (CO of a γ-lactone ring), 1733 (CO of an ester group), and 1670 (double bonds). The band of an OH group was absent. A comparison of the physicochemical properties of substance **(1)** and its acetyl derivative with those of artabin and its acetate [1, 2], likewise isolated from common wormwood, gathered in the Tashkent oblast, enabled the compound under investigation to be identified as artabin.

Substance (2) had absorption bands in its IR spectrum at (cm^{-1}) 3540 and 3375 (OH groups), 1757 (CO of a γ-lactone ring), and 1650 (double bond). In the UV spectrum there were no absorption bands in the 200-250 nm region.

The NMR spectrum of (2) showed doublets at (ppm) 1.16 (3H, J = 7 Hz, $CH_3-CH=$) and 1.20 (3H, J = 7 Hz, $CH_3-CH=$), a sextet at 4.43 (1H, $J_1 = 3$, $J_2 = J_3 = 11$ Hz, gem-hydroxylic proton), a doublet at 4.47 (1H, J = 11.5 Hz, CH–OH), each component being split because of allyl coupling into a triplet with a spin–spin coupling constant (SSCC) of 2 Hz, a quartet at 4.99 (1H, $J_1 = 9$ Hz, $J_2 = 4$ Hz, lactone proton), and one-proton doublets of an exomethylene group at 5.37 (J = 2 Hz) and 5.62 (J = 2 Hz).

The presence of two secondary methyl groups and one exomethylene group in the molecule of the compound showed that the lactone under investigation was based on a germacrane or guaiane carbon skeleton. The quartet splitting and the ratio of the intensities of the components of the signal of the lactone proton showed that the compound was based on a guaiane carbon skeleton and that the lactone ring was located at C6–C7. A comparison of the facts given with the characteristics of sesquiterpenes known in the literature enabled us to conclude that this compound was new, and we propose the name absindiol for it.

In a discussion of the question of the locations of the two secondary hydroxy groups and of the methylene double bond in the absindiol molecule, it must be noted that the sextet splitting of the signal at 4.43 ppm belonging to one of the gem-hydroxylic protons is analogous in nature to the signal of the gem-hydroxylic proton (H8) of matricarin [3] and that of badkhysin [4], each interacting with three vicinal protons. Consequently, one of the hydroxy groups in the molecule of the compound under investigation is present at C8, and the SSCCs enable this hydroxy group to be ascribed the α-orientation. So far as concerns the second hydroxy group and the methylenic double bond, they are apparently present on vicinal carbon atoms; i.e., in the five-membered ring at C3 and C4, respectively. The doublet structure with additional splitting of the components into triplets (J = 2 Hz) of the H3 signal and the 2-Hz splitting of the signals of the exomethylene protons, as well, confirmed this point of view.

The results obtained on the oxidation of absindiol with chromic anhydride also confirmed the correctness of the proposal put forward. It led to a derivative with the composition $C_{15}H_{18}O_4$, mp 151-152°C (from ethanol), the IR spectrum

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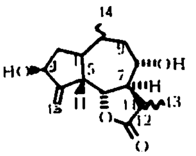
of which included the absorption bands of the carbonyl of a γ-lactone ring (1780 cm^{-1}), of a ketone group in a seven-membered ring (1718 cm^{-1}), of a conjugated ketone group in a five-membered ring (1690 cm^{-1}), and of a conjugated double bond (1600 cm^{-1}). The UV spectrum confirmed the presence of the above-mentioned chromophores: λ_{max} 238 nm (log ε 3.92) and 292 nm (log ε 1.87).

It must be mentioned that the NMR spectrum of the latter retained the signals of an exomethylene group (at 5.35 and 5.48 ppm), which excluded the possibility of the formation of a conjugated system through migration of the double bond.

Thus, the spectroscopic and chemical results, taking into account the SSCCs of the protons, permit us to ascribe to absindiol the structure of 3β,8α-dihydroxy-5βH,6βH,7αH,8βH-guai-4(15)-en-6,12-olide.



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EXPERIMENTAL

IR spectra were taken on a UR-20 spectrophotometer in paraffin oil, UV spectra on a SF-4a instrument in ethanol, and NMR on a Varian HA-100 D spectrometer in deuterated pyridine and deuterated chloroform. Chemical shift are given on the δ-scale, TMS — 0.

Isolation of Artabin and Absindiol. A 10-g portion of the dark green resin obtained by the threefold acetone extraction of 0.4 kg of the comminuted air-dry epigeal part of common wormwood (yield 4.5%) was chromatographed on a column of neutral alumina (activity grade IV, 3.5 × 80 [cm]). Elution was performed with hexane, hexane–benzene (3:2, 1:1, and 1:4), benzene, benzene–chloroform (2:1, 1:1, 1:2, 1:3, and 1:4) and chloroform. The fractions eluted by benzene yielded 0.08 g of a crystalline substance with the composition $C_{15}H_{22}O_3$, mp 161-163°C. From the last fractions, eluted by chloroform, we isolated a substance with the composition $C_{15}H_{22}O_4$, mp 124-125°C. Yield 2% of the weight of the resin.

Acetylation of Artabin. A solution of 0.05 g of the substance in 1 ml of pyridine was treated with 1 ml of acetic anhydride. The mixture was heated in the water bath for 30 min and was then left at room temperature for 24 h and was worked up by a known method [5]. A crystalline substance with the composition $C_{17}H_{24}O_4$, mp 170-172°C (from aqueous alcohol), was obtained.

Oxidation of Absindiol. A solution of 0.1 g of absindiol in 3 ml of acetone was treated with 0.2 g of CrO_3 in 4 ml of acetone. The reaction mixture was left at room temperature for 5 h and was then worked up by a known method [6], giving a substance with the composition $C_{15}H_{18}O_4$, mp 151-152°C.

EXPERIMENTAL

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