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SESQUITERPENE LACTONES OF ARTEMISIA SPECIES.
III. ARGLANINE FROM ARTEMISIA DOUGLASIANA BESS.

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Artemisia douglasiana Bess., a member of the complex of species allied to *A. vulgaris* L., is a common perennial of the western United States.* We have found the spring growth** to contain a number of sesquiterpene lactones, one of which is arglanine, 11,13-dehydrovulgarin.

Arglanine (I), m.p. 207°, $[\alpha]_D^{24}$ + 111°, obtained in 0.18% yield, has the composition $C_{15}H_{18}O_4$, and shows the spectral characteristics that are typical of a γ-lactone possessing an exocyclic methylene group. Its n.m.r. spectrum shows a striking resemblance in many of its features to that of vulgarin (tauremisin)[2,3] (II), differing from the latter in two important respects: it lacks the high-field doublet of the C-11 methyl group of vulgarin, and contains the pair of doublets (5.52 and 6.18 ppm, J=3 cps) characteristic of the exocyclic $=CH_2$ group of the lactone ring. Arglanine contains a hydroxyl group that is resistar to acetylation and to chromic acid oxidation, and its n.m.r. spectrum shows the AB pattern of the hydrogen atoms of a -CH=CH-CO- system. The near identity of the signals for this AB pattern and of that of the lactonic -CH-O proton with those found in the n.m.r. system of vulgarin, coupled with the close taxomic relationship of *A. vulgaris* L. and *A. douglasiana*

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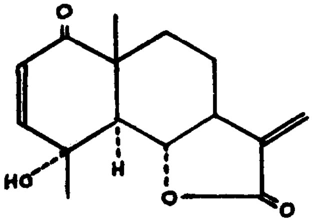
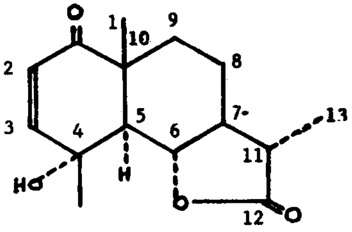
* Among its synonyms is *A. vulgaris heterophylla* Hall and Clements.

** Young (spring) growth is markedly different in chemical constitution from mature, flowering (fall) plant. This observation will be discussed in later communications

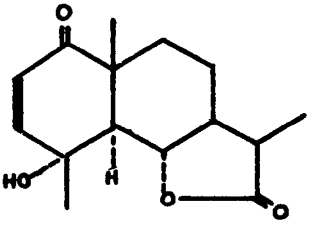
Bess., suggested at once that arglanine was 11,13-dehydrovulgarin.



I



II



III

The mass spectra of vulgarin and arglanine both show a series of peaks (the molecular ion, M^+; a base peak, M-15; a peak M-15-18; and several others) that are nearly identical in relative intensity but differ in the two spectra by two mass units. This could be accommodated by the view that the early fragmentations of the two compounds followed the same path to lead to ions that differed only in the C-11, C-13 position ($=CH_2$ vs. $CHCH_3$).

Confirmation of the structure of arglanine was obtained by hydrogenation. The absorption of one mole of hydrogen produced a mixture of two compounds which were separated by chromatography. One of these was vulgarin (II), to which it was shown to be identical by comparison with an authentic sample by melting point, mixed melting point, n.m.r. and infrared spectra, and thin-layer chromatography. The second compound was 11-epivulgarin (III), m.p. 170-170.5°, which had nearly the same n.m.r. spectrum as vulgarin. A mixture of II and III showed a depression in melting point (166-168°). The behavior of II and III on thin-layer chromatography was nearly identical.

11-Epivulgarin and vulgarin were distinguished by the fact that the C-11 methyl groups showed a difference in the change in chemical shifts in the n.m.r. spectra measured in benzene and in deuterochloroform.[4] Moreover, the values of δ(benzene) - $\delta(CDCl_3)$ for the C-11 methyl groups of II and III were in agreement with and further substantiate the previously assigned stereochemistry at C-11 for vulgarin (α-CH_3), and thus for III (β-CH_3).

That no alteration in the stereochemistry at C-5, C-6 and C-7 occurred in the conversion of I to II and III is shown by the fact that the chemical shifts and coupling patterns for the $-\overset{|}{C}H-O$ proton at C-6 are virtually identical for all three compounds.

The close structural similarity between arglanine and vulgarin is, of course, quite in harmony with the close relationship of the plants in which they are found. The structure of another lactone of *A. douglasiana* Bess., douglanine,[5] further extends this structural-taxonomic relationship.

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