3. I. P. Kovalev and E. V. Titov, Infrared Absorption Spectra of Some Groups of Natural Compounds [in Russian], Khar'kov, 1966.

4. R. Bognar, V. Szabo, and R. E. David, Acta Phys. Chim., **5**, 6, 1959.

5. V. I. Litvinenko and N. P. Maksyutina, KhPS [Chemistry of Natural Compounds], **1**, 420, 1965.

15 July 1968

Kiev Institute for Advanced Medical Training

Khar'kov Chemical and Pharmaceutical Scientific-Research Institute

---

UDC 547-314:633.88

STIZOLIN — A NEW SESQUITERPENE LACTONE FROM STIZOLOPHUS BALSAMITA

M. N. Mukhametzhanov, V. I. Sheichenko, A. I. Ban'kovskii, K. S. Rybalko, and K. I. Boryaev

Khimiya Prirodnykh Soedinenii, Vol. 5, No. 1, pp. 56–57, 1969

From the leaves of Stizolophus balsamita (Lam.) Cass. ex Takht. family Compositae, collected on June 28, 1967, in the region of the Kurdai Mountains (Kazakhstan), we have isolated a new sesquiterpene lactone—stizolin $C_{15}H_{20}O_4$ with mp 184.5–186.5° C (decomp.; from benzene) $[\alpha]_D^{20}$ −30.46° (c 2.68; chloroform). Its IR spectrum has absorption bands at 3560 cm^{-1} (OH group) and 1757 and 1650 cm^{-1} (carbonyl of an α-methylene-γ-lactone ring). Stizolin contains one OH group (determined by the Chugaev-Tserevitinov [Zeriwitinoff] method); on oxidation with chromic anhydride in pyridine, dehydrostizolin $C_{15}H_{18}O_4$ was obtained with mp 219–221° C (decomp.; from ethanol); ν_{max} 1775 cm^{-1} (C=O of a γ-lactone), 1712 cm^{-1} (C=O) and 1665 cm^{-1} (C=C).

On hydrogenation of a Pt catalyst (according to Adams) in glacial acetic acid, 2 moles of hydrogen were consumed and a tetrahydro derivative $C_{15}H_{24}O_4$ was formed with mp 180–182° C (from ethanol), ν_{max} 3542 cm^{-1} (OH), 1785 cm^{-1} (γ-lactone); acetyltetrahydrostizolin $C_{17}H_{26}O_5$ with mp 169–170.5° C (from ethanol), ν_{max} 1780 cm^{-1} (γ-lactone), and 1725 and 1255 cm^{-1} ($OCOCH_3$). The oxidation of tetrahydrostizolin with chromic anhydride in 90% acetic acid led to the formation of dehydrotetrahydrostizolin $C_{15}H_{22}O_4$ with mp 199–201.5° C (from ethanol), ν_{max} 1785 cm^{-1} (γ-lactone), 1707 cm^{-1} (C=O). These results show that the OH group in stizolin is secondary.

Stizolin does not form derivatives for a keto group and therefore the fourth carbon atom is present either in the form of an epoxide or as part of a furan ring.

When stizolin was hydrogenated over a Pt catalyst (according to Adams) in ethanol, one mole of hydrogen was absorbed and dihydrostizolin $C_{15}H_{22}O_4$ was formed with mp 198–200° C (from ethanol), ν_{max} 3550 cm^{-1} (OH) and 1757 cm^{-1} (γ-lactone); acetyldihydrostizolin $C_{17}H_{24}O_5$ with mp 180–183° C (from ethanol), ν_{max} 1770 cm^{-1} (γ-lactone), 1735 and 1250 cm^{-1} ($OCOCH_3$). Dihydrostizolin was reduced with lithium aluminum hydride, giving a liquid glycol $C_{15}H_{28}O_4$; ν_{max} 3360–3440 cm^{-1} (OH) and 1655 cm^{-1} (C=C) which was dehydrogenated in the presence of selenium at 290–310° C for 30 min. From the reaction products were isolated chamazulene (identified by thin-layer chromatography) and linderazulene (identified through the trinitrobenzoate $C_{15}H_{14}O \cdot C_6H_3N_3O_6$) with mp 154–156.5° C (from ethanol).

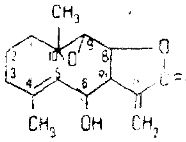
It is known that azulenes are formed not only by the dehydrogenation of sesquiterpenoids of the azulene series but also by the dehydrogenation of sesquiterpenoids of the germacrane type. With the composition $C_{15}H_{20}O_4$ and two double bonds, a bicyclic structure for stizolin is excluded. Consequently, it is a monocyclic compound, and the formation of linderazulene shows that it belongs to the sesquiterpene lactones of the germacrane type with the lactone ring at C_7—C_8 and the double bond at C_1—C_{10} or at C_4—C_5.

The NMR spectrum of stizolin has two singlets: one at 1.20 ppm (CH_3 attached to an epoxide) and the other at 1.65 ppm (CH_3 on a double bond); there are also signals of an epoxide proton (doublet at 2.86 ppm), a lactone proton (triplet at 4.10 ppm), and a proton present in the geminal position with respect to a hydroxyl at 4.05 ppm; in the 5.1–5.5 ppm region are signals of vinyl and hydroxyl protons, and in the 6.4 and 6.6 ppm regions signals of an exocyclic methylene group.

The NMR spectrum of tetrahydrostizolin shows two CH_3 groups attached to CH (doublet at 1.06 ppm and 1.50 ppm) and a CH_3 group attached to an epoxide (singlet at 1.43 ppm). The signal of the epoxide proton is found in the 3.01 ppm region (doublet), the lactone proton has remained in the form of a proton at 3.89 ppm, and the proton in the geminal position to the hydroxyl is expressed in the form of a multiplet at 4.09 ppm and the hydroxyl proton in the form of a signal at 4.98 ppm.

The form of the signal of the lactone proton (triplet) is preserved in all the derivatives of stizolin mentioned above, which shows the invariability of the $C_7-C_8-C_9-C_{10}$ fragment in the molecules. The low value of the position of the signal of the proton in the gem position to the OH group and its position adjacent to the lactone proton, and also the small chemical shift between the protons of the exocyclic methylene group in stizolin can be explained by the location of the hydroxyl in direct propinquity to the lactone ring. This is also in accord with the NMR spectrum of dehydrostizolin, where the signals of the exocyclic methylene are expressed in the form of doublets at 6.37 ppm and 5.53 ppm, which is customary for an exocyclic methylene attached to a γ-lactone ring.

The facts presented permit structure (I) to be proposed as the most probable for stizolin.



I

30 May 1968

All-Union Scientific-Research Institute for Medicinal Plants

UDC 547.581.972.913

A STUDY OF THE CHEMICAL COMPOSITION OF ARTEMISIA ABSINTHIUM

I. S. Akhmedov, Sh. Z. Kasymov, and G. P. Sidyakin

Khimiya Prirodnykh Soedinenii, Vol. 5, No. 1, pp. 57-58, 1969

An investigation of the chemical compositions of representatives of the genus Artemisia L. (wormwoods and sagebrushes) has begun in the Laboratory of the Chemistry of Terpenes and Acids of the Institute of the Chemistry of Plant Substances of the Academy of Sciences of the Uzbek SSR.

The epigeal part and the roots of A. absinthium L. were collected in the period of flowering of the plant (beginning of June) in the Tashkent Oblast and were separately extracted with chloroform. Fifty kilograms of the epigeal part gave 2900 g (5.8%) and 7.5 kg of the roots gave 525 g (7.0%) of total extractive substances. Treatment of the extract of the epigeal part with ether gave 763 g of a powder from which, using petroleum ether, a hydrocarbon $C_{29}H_{60}$ with mp 63° C was isolated. The ethereal solution was shaken with 3% potassium carbonate solution and acidified with hydrochloric acid, and the substances of an acidic nature (408 g) were extracted with chloroform.

The phenols were extracted from the ethereal solution with 0.5% caustic potash and after acidification of the alkaline solution they were re-extracted with chloroform. Yield 102 g. This mixture was treated with petroleum ether and then with acetone. The insoluble substance (3 g) had 162-163° C (from methanol). It consisted of 5-hydroxy-3,6,7,3',4'-pentamethoxyflavone, i.e., artemetin [1,2].

By extraction of the epigeal part with petroleum ether and further treatment of the extract with acetone we obtained the sesquiterpene lactone artabsin [3,4].

The extract from the roots was dissolved in ether and treated with sodium carbonate, and it was then acidified and the acids were extracted with chloroform. Using ether, an acid was isolated with mp 167° C which proved to be 3,4,5-trimethoxybenzoic acid. For identification, this substance was prepared by methylating gallic acid [5]. The methyl esters of the natural and synthetic acids were likewise identical.

Trimethoxybenzoic acid has been found for the first time in plants of the genus Artemisia L.

REFERENCES

1. M. M. Adrian and A. Trillat, Bull. Soc. Chim., 19, 1014, 1898.
2. Z. Cekan and V. Herout, Coll. Czech. Chem. Commun., 21, no. 1, 79, 1956.
3. V. Herout and F. Sorm, Coll. Czech. Chem. Commun., 18, 854, 1953.
4. V. Herout, Dolejs, and F. Sorm, Chem. listy, 51, no. 8, 572, 1957.
5. Preparative Organic Chemistry [in Russian], p. 355, 1964.

30 September 1968

Institute of the Chemistry of Plant Substances, AS UzSSR