It must be mentioned that (+)-reticuline is one of the components leading to high results in the method of determining morphine in opium poppy capsules according to VTU [Official Technical Standard] 37-58 [5]. The cause of the high results is that (+)-reticuline is not completely separated from morphine under the conditions laid down in the method and forms colored solutions with sodium nitrite and ammonia in the same way as morphine.

The combined alkaloids from the capsules of the new variety of the opium poppy Mayak were separated into three fractions according to their basic strengths (pH 4.5, 6.0, and 9.0). The fractions obtained were chromatographed on columns of alumina (activity grade II) followed by preparative chromatography in thin layers of alumina and of silica gel L.

The pH 4.5 fraction yielded papaverine, narcotine, thebaine, laudanidine, and narcotoline — the pH 6.0 fraction gave codiene and cotarnoline as the products of the cleavage of narcotoline [6, 7]; and the pH 9.0 fraction gave morphine. The yield of morphine from the capsules of poppies of variety Mayak was 20-30% greater than the yield of morphine from the capsules of the variety Novinka-198 grown under similar conditions.

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FORMATION OF BERBERRUBINE CHLORIDE IN THE DEHYDROGENATION OF DL-CANADINE

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The alkaloid berberine possesses a broad spectrum of pharmacological, chemotherapeutic, and antitumoral activity [1, 2]. In view of this, we considered it of interest to synthesize a number of berberine analogs in order to investigate their physiological activity. At our disposal were the alkaloids β-allocryptopine and L-kanadine β-chloromethylate, isolated previously [3, 4] from the plant *Thalictrum minus* L. (family Ranunculaceae), which is fairly widely distributed in the territory of the Moldavian SSR and is characterized by a high alkaloid content. In the first place, we attempted to obtained dehydroberberinium chloride [5] from L-canadine β-chloromethylate. The latter was converted into canadine by treatment with sodium thiophenolate [6] and was then subjected to dehydrogenation. For this purpose, an ethylene glycol solution of the initial substance weakly acidified with concentrated hydrochloric acid was heated in an inert atmosphere with one of the following catalysts: 10% palladium on carbon (6 h, bath temperature 195-200°C), a Pd catalyst prepared according to Brown [7] (2 h, 180-185°C), and the triphenylphosphine complex of rhodium $Rh[(C_6H_5)_3P]_3Cl$ [8] (2.5 h, 170°C). In the use of the first two catalysts, maleic acid was added to the reaction mixture as hydrogen acceptor. In all cases, the same final product was formed [R_f 0.68 in chromatography on Silufol in the methanol–hydrochloric acid (9:1) system]. On heterogeneous catalysis it was possible to observe the formation during the reaction process of

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an intermediate compound having the same R_f values as berberine (0.58) and giving the same color of the spot when the plate was treated with iodine. The substance isolated in the form of the hydrochloride, $C_{19}H_{16}ClNO_4$, had decomp. p. 280°C, λ_{max} (in ethanol) 233, 274, 353 mμ (log ε 4.46, 4.43, 4.38) and differed in its melting point, elementary analysis, and UV spectrum from dehydroberberinium chloride. The corresponding free base with a molecular weight of 321 (mass spectrometry) crystallized from water in the form of dark red needles with mp 288°C and had physicochemical properties similar to those of berberine [9]. However, the melting point of the salt did not agree with the melting point of berberine chloride given in the literature [10]. The NMR spectrum of this product, taken in CF_3COOH contained the following signals (ppm): 4.14 (singlet, 3 H, OCH_3); 6.07 (singlet, 2 H, $O-CH_2-O$); 6.88, 7.45, 7.86 (2 H), 8.38 and 9.61 (6 aromatic H's), i.e., it showed great similarity, just like its UV spectrum, with the corresponding spectra of thalifendine chloride [11], which differs from berberine chloride only by the positions of the CH_3O and HO groups. To choose between these two structures, the substances were reduced with hydrogen in the presence of Adams catalyst or with sodium tetrahydroborate in methanol, giving a product with mp 178-180°C with constants similar to those of DL-tetrahydroberberrubine [12]. The UV spectrum of this substance coincided with that of the alkaloid nandinine [13], which is known to have the structure of tetrahydroberberrubine. The mass spectrum gave the fragmentation characteristic for this class of compounds [14]. Consequently, the identity of the product obtained as DL-tetrahydroberberrubine is not a matter of doubt.

Thus, the dehydrogenation of canadine gives berberrubine chloride, i.e., the dehydrogenation of canadine takes place only partially, leading to the formation of berberine chloride which then splits out a molecule of methyl chloride and is converted into berberrubine. In the presence of $Rh[(C_6H_5)_3P]_3Cl$, the dehydrogenation process takes place far more rapidly than on heterogeneous catalysis, and it is apparently for this reason that it is impossible to detect the intermediate formation of berberine.

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