

**Veratrum alkaloids. XXX.\***  
**Isolation and characterization of principal alkaloids**  
**from the underground part of *Veratrum nigrum* L.**

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Jervine and the hypotensive-active ester alkaloid veratroylzygadenine were isolated from the underground part of *Veratrum nigrum* L. growing in our country. The identity of both alkaloids was proved on the basis of spectral data and comparison with the authentic specimens.

Из подземной части растений *Veratrum nigrum* L., которые растут у нас был изолирован ервин и эфирный алкалоид вератроилзигаденин, обладающий гипотензивным действием. Оба алкалоида были идентифицированы на основе спектров и сравнения с достоверными образцами.

Although alkaloids present in various species of the *Veratrum* family were investigated in detail [1—4], those of *Veratrum nigrum* L. have been mentioned only sporadically [5]. The hypotensive-active ester alkaloids derived from alkalamines germine, protoveratrine, and zygadenine are of pharmacologic interest. Veratroylzygadenine, isolated for the first time from *Zygadenus venenosus* [6] was also found in other species of the *Veratrum* family [7, 8].

So far, three alkaloids have been isolated from *Veratrum nigrum* L. growing in the USSR: jervine from the underground and rubijervine and verazine from the aerial parts [9, 10]; the presence of the ester alkaloid veratroylzygadenine has not been reported [5]. *Veratrum nigrum* L. is growing in East Asia; in our country this species is very rare, and consequently, it is protected. It has been found at two localities: at meadows in the southern part of Biele Karpaty not far from the village Suchov near Velká and at the Bílichovské údolí near Louny.

The drug worked up in our laboratory originated both in Biele Karpaty and Medical Plant Garden, Faculty of Medicine, J. E. Purkyně University, Brno. The purified extract of ground roots and rhizomes afforded, upon separation by means of column and preparative thin-layer chromatography two substances displaying a positive Dragendorff test. Another two substances present in the extract were not studied in detail.

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\* For Part XXIX see *Chem. Zvesti* **32**, 120 (1978).

Substance of molecular formula  $C_{27}H_{39}NO_3$  showed in its mass spectrum, in addition to the peak of molecular ion, further fragments characteristic of alkaloid jervine [11]. The i.r. spectrum had vibration bands at  $1385\text{ cm}^{-1}$  (angular methyl groups),  $1625$  and  $1690\text{ cm}^{-1}$  (an  $\alpha,\beta$ -unsaturated ketone),  $2940\text{ cm}^{-1}$  (methyl and methylene groups) and  $3400\text{ cm}^{-1}$  (broad, a hydroxyl group). These data let us suggest this base to be jervine, this being confirmed by comparison with the specimen.

The mass spectrum of the second substance revealed the peak of molecular ion satisfying molecular formula  $C_{36}H_{51}NO_{10}$  and other species indicative of the alkaloid veratroylzygadenine [12]. Bands in the i.r. spectrum at  $1520$  and  $1610\text{ cm}^{-1}$  were associated with the presence of an aromatic ring, other bands at  $1725$  and  $2760$ ,  $2780$ ,  $2815$ ,  $2840\text{ cm}^{-1}$  with the ester grouping and a *trans*-quinolizidine ring (Bohlman bands), respectively; that at  $3400\text{ cm}^{-1}$  was due to hydroxyl groups. These arguments allowed to ascribe structure of veratroylzygadenine to this base. The correctness of this presumption was verified by comparison with the authentic specimen.

## Experimental

Melting points were determined on a Kofler micro hot-stage, infrared spectra were recorded with a Perkin—Elmer 477 spectrophotometer in KBr discs, ultraviolet spectra with a Specord UV VIS instrument, and mass spectra with an AEI-MS 902 apparatus. The occurrence of alkaloids was monitored by thin-layer chromatography on Silica gel G (Merck) in the solvent system chloroform—methanol—benzene 8 : 1.5 : 0.5; visualization with Dragendorff reagent and conc. sulfuric acid and subsequent heating at  $120^\circ\text{C}$  for 5 min, respectively. The chromatograms were developed 5 times in the given solvent system. Silica gel for column chromatography No. 4 was prepared according to [13].

### Isolation of alkaloids

The dried ground drug (132 g, locality Biele Karpaty) was moistened with a 7.5% solution of  $\text{NaHCO}_3$  and allowed to swell. After this period the drug was macerated for 24 h 4 times with benzene, the solvent was thickened under reduced pressure and alkaloids were quantitatively extracted with 5% tartaric acid. The acid portion was basified with dilute ammonia to pH 10, cooled and extracted with benzene and chloroform. Organic layers were evaporated to dryness *in vacuo* at max.  $45^\circ\text{C}$ . Yield 1.04 g.

The same procedure was applied to the drug (73 g) from locality Brno; yield 0.43 g. Since both samples consisted, as checked by thin-layer chromatography, of the same substances, they were combined and separated on a silica gel column (1 : 50 weight ratio) using the mixture chloroform—methanol—benzene 8 : 0.5 : 1.5 as eluent (fractions 10 ml each).

Jervine (8 mg) was isolated from fractions 6—8. Melting point  $236\text{--}239^\circ\text{C}$ ,  $R_f$  0.88.  $M^+$  425.6152 for  $C_{27}H_{39}NO_3$  (calculated 425.6168), further peaks at  $m/e$  410, 407, 396, 392, 314, 233, 125, 124, 110. The u.v. spectrum  $\lambda_{\text{max}}^{\text{MeOH}}$  253 nm ( $\log \epsilon$  4.90).

Veratrolyzygadenine (5 mg) was obtained from fractions 9—11. Melting point 258—262°C,  $R_f$  0.42.  $M^+$  657.7978 for  $C_{36}H_{51}NO_{10}$  (calculated 657.8086), further peaks at  $m/e$  575, 492 (M-veratroyl), 475 (M-veratric acid), 474, 458, 456, 430, 418, 182 (veratric acid), 165 (veratroyl), 112, 111, 98. The u.v. spectrum  $\lambda_{\max}^{MeOH}$  264, 295 nm (log  $\epsilon$  4.94, 4.67).

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