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SOLAVERBASCINE—A NEW 22,26-EPIMINOCHOLESTANE ALKALOID FROM *SOLANUM VERBASCIFOLIUM**

G. ADAM*, H. TH. HUONG* and N. H. KHOI†

* Institute for Plant Biochemistry, Halle/Saale, of the Academy of Sciences of the GDR, German Democratic Republic; † Institute for Sciences, Hanoi, Socialist Republic Vietnam.

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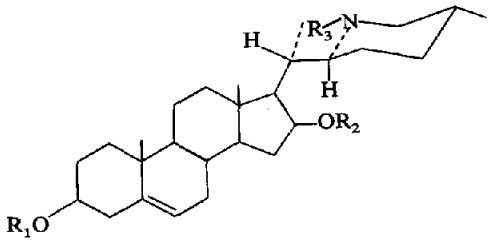
Key Word Index—*Solanum verbascifolium*; Solanaceae; steroidal alkaloids; 22,26-epiminocholestanes; solaverbascine.

Abstract—Besides solasodine and tomatidine the new alkaloid solaverbascine has been obtained from the leaves of *Solanum verbascifolium* and identified as (22*S*:25*R*)-22,26-epiminocholest-5-ene-3β, 16β-diol by physical data and direct comparison with synthetic material.

Solanum verbascifolium L. is used in folk-medicine of East Asia particularly against skin disease and as an abortivum [1]. Payen and Chevalier [2] have already reported the isolation of 'traces of solanine' from this plant whereas later on the identification of the glycoalkaloids α-solasonine [3, 4] and β-solamargine [3] was described. In a variety of *S. verbascifolium* collected in Cuba, the alkaloids solasodine, solasodiene, solafloridine and tomatidenol were found [5]. We now wish to report the structure of the new steroidal alkaloid solaverbascine (**1**) isolated from Vietnamese plant material of this species.



1 $R_1 = R_2 = R_3 = H$
2 $R_1 = R_2 = R_3 = Ac$
3 $R_1 = R_2 = H, R_3 = Cl$
4 $R_1 = R_2 = H, R_3 = NO$

MeOH extraction of the dried leaves after acidic hydrolysis of the obtained glycosidic mixture followed by Si gel chromatography yielded, besides 0.26% solasodine and 0.05% tomatidine, 0.01% of the new alkaloid $C_{27}H_{45}NO_2$(M^+ 415.3417) showing IR absorption (nujol) at 1045, 1060, and 3200–3500 cm^{-1} (br, OH and NH). The 100 MHz NMR spectrum ($CDCl_3$, TMS as internal reference) gave signals at δ3 0.83 (*d*, $J = 7$ Hz, 27-H_3) [6], 0.96(*s*, 18-H_3), 1.05(*s*, 19-H_3), 1.09(*d*, $J = 7$ Hz, 21-H_3), 3.51(*m*, 3α-H), 4.45(*m*, 16α-H), 5.34(*d*, 6-H). MS indicates that **1** is a steroidal alkaloid having a 22,26-epiminocholestane skeleton, high resolution diagnostic ion fragments being discernible at *m/e* 400($C_{26}H_{42}NO_2$), 168($C_{10}H_{18}NO$), 140($C_{10}H_6N$), 126($C_8H_{16}N$), 99 and 98($C_6H_{12}N$, base peak) [6–8]. As found for veratramine [7], a peculiarity in the cation MS of **1** is the simultaneous appearance of intense M^+-1 and M^++1 peaks besides the M^+ depending in their relative abundance on the applied recording conditions. The alkaloid was characterized as the *O*, *O*, *N*-triacetyl derivative **2**, M^+ 514, mp 171°, $[\alpha]_D^{22}$ −16.8°; *N*-chloroamine **3**, mp 260° (dec.), $[\alpha]_D^{22}$ −106.0°; and the *N*-nitrosamine compound **4**, mp 256°, $[\alpha]_D^{22}$ −38.3°. The observed molecular rotation differences for the transformations **1** → **3** ($[M]_D = -195°$) and **1** → **4** ($[M]_D = +109.7°$) indicated a (22*S*)-configuration and in connection with the ^1H NMR doublet at δ(ppm) 0.83 for the equatorial 27-methyl [6] the (25*R*)-stereochemistry of the epiminocholestane side chain moiety. All these data suggested the alkaloid as solaverbascine ((22*S*:25*R*)-22,26-epiminocholest-5-en-3β, 16β-diol, dihydrosolasodine A (**1**)); this structure was finally confirmed by a partial synthesis of **1**, reductive opening of ring E in solasodine [9] leading to a product identical in all respects with solaverbascine (**1**) isolated from *S. verbascifolium*. A photochemical degradation of synthetic **1** to steroidal hormone analogues has been described [10].

Solasodiene, solafloridine and tomatidenol [5] could not be detected in our plant material indicating a remarkable variation in the steroidal alkaloid content of *S. verbascifolium* from different geographical regions. Besides the *N*-methylated alkaloid hapepunine from *Fritillaria camtschatcensis* [11], solaverbascine is

† Part 107 in the series "*Solanum* Alkaloids". For Part 106, see Adam, G., Huong, H. Th., Lischewski, M. and Khoi, N. H. (1978) *Phytochemistry* **17**, 1070. Part 5 in the series "Natural Products from Vietnamese Plants". For Part 4 see Chien, N.q. and Adam, G. (1980) *Pharmazie* (in press).

the first member which was isolated from natural sources as 16β-hydroxylated 22,26-epiminocholestane differing from teinemine and isoteinimine from *Veratrum grandiflorum* [12] only in the configuration at C-16 and the piperidine moiety. The occurrence of such compounds is of particular interest with regard to the biogenetical correlations between the different C_{27} alkaloid structural types [13] which could lead from solaverbascine via redox reactions to the spiroaminoketal solasodine (or reversed) as well as to the solanidine type.

EXPERIMENTAL

Mps are corr. Specific rotations in $CHCl_3$; ^1H NMR in $CDCl_3$ with TMS as int. standard. *S. verbascifolium* was identified by Dr. Loc (University of Hanoi) and a voucher specimen is kept at the Department of Botany, University of Hanoi.

Isolation. Dried and powdered leaves (500 g), collected near Hanoi, were sucessively extracted with $CHCl_3$ and MeOH in a Soxhlet. The MeOH soln was concd to dryness under red. pres. acidified with 0.5 N HCl and extracted ×3 with C_6H_6–Et_2O to remove pigments. The aq. layer was neutralized with NH_3 and the glycoside mixture extracted exhaustively with $CHCl_3$–EtOH(3:2). Following acid hydrolysis (N HCl, 1 hr reflux) the aglycones were recovered by extraction with $CHCl_3$–EtOH (19:1). Evaporation of the organic phase gave a residue which was chromatographed over Si gel (Woelm, neutral, grade II). The progress of the separation was followed by TLC on Si gel (Merck) using $CHCl_3$–MeOH(9:1). Elution with $CHCl_3$–MeOH(45:1) yielded tomatidine. Plates ($CHCl_3$–Me_2CO), mp 204°, $[\alpha]_D^{25}$ +70°(*c* 0.4), identical mmp, R_f, IR with an authentic specimen [14]. Elution with $CHCl_3$–MeOH(19:1) gave solasodine. Plates (Me_2CO–H_2O), mp 195°, $[\alpha]_D^{24}$ −104.3°(*c* 0.3), identical with an authentic specimen from *S. laciniatum* [13]. Elution with $CHCl_3$–MeOH(9:1) afforded solaverbascine (**1**). Crystals (MeOH–H_2O), mp 263–265°, $[\alpha]_D$ −67.9°(*c* 0.3). Spectral data in the text. The derivatives **2–4** were prepared as described earlier for synthetic **1** [14].

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