Tetrahedron Letters,Vol.24,No.16,pp 1735-1736,1983 0040-4039/83/161735-02$03.00/0
Printed in Great Britain

STRUCTURE OF GYMNOPILIN, A BITTER PRINCIPLE OF AN HALLUCINOGENIC MUSHROOM, GYMNOPILUS SPECTABILIS

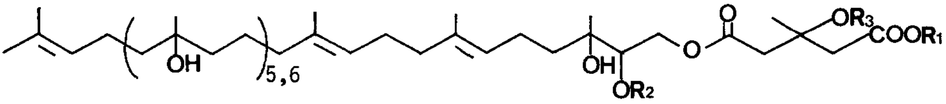
Shigeo NOZOE*, Yutaka KOIKE, Genjiro KUSANO, Haruo SETO†

Pharmaceutical Institute, Tohoku University, Aobayama,
Sendai 980, Japan
†Institute of Applied Microbiology, University of Tokyo,
Bunkyo-ku, Tokyo 103, Japan

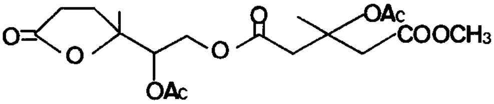
Summary: Structure of gymnopilin (1), a bitter principle of an hallucinogenic mushroom Gymnopilus spectabilis, was elucidated by chemical degradation and spectroscopic methods.

In our previous paper the isolation and structure of gymnoprenols, a novel type of polyisoprenepolyols with 45 to 60 carbon atoms obtained from the fruit bodies of Gymnopilus spectabils$^{1)}$, were reported. As the major component designated as gymnoprenol-F has been found to be a bitter principle of this mushroom, the structure of this compound renamed gymnopilin was investigated by chemical and spectroscopic methods. In the present communication we wish to report that gymnopilin possesses the structure represented by 1.

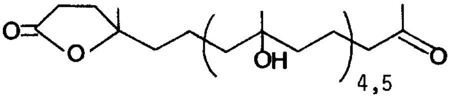
Gymnopilin purified by means of preparative HPLC using a Lichroprep RP-8 column; rt 4.6 min$^{2)}$; exhibits pmr signals at 1.60 (3H,s), 1.62 (3H,s), 1.63 (3H, s), 1.67 (3H, s), 1.99 (6H, m), 2.09 (4H, m),5.13(3H, m); cmr, 16.0 (1C, q), 16.1 (1C, q), 17.7 (1C,q), 25.9 (1C, q), 125.5 (1C, d), 125.9 (2C, d), 131.9 (1C, s) and 136.0 (2C,s), indicating the presence of three trisubstituted double bonds including a terminal isopropylidene group the same as in gymnoprenol-A$^{3)}$. Gymnopilin also shows signals due to a vicinal diol moiety at 3.65 (1H, dd, J=2,9 Hz), 4.05 (1H, dd, J=9, 11.5Hz) and 4.39 (1H, dd, J=2, 11.5Hz) in the pmr spectrum and 67.1 (1C, t), 75.8 (1C, d) in the cmr spectrum, all of which correspond to the signals appearing at 3.46, 3.53, 3.78 and 64.0, 78.2, respectively, in the nmr spectrum of gymnoprenol-A. Besides the signals mentioned above, gymnopilin exhibits additional ones at 27.9 (1C, q), 47.2 (1C, t), 47.5 (1C, t), 71.0 (1C, s), 172.9 (1C, s, -OCO-) and 178.8 (1C, s, COOH), indicating that gymnopilin contains gymnoprenol-A in the molecule and is an ester of a dicarboxylic acid. This was supported by the fact that alkaline hydrolysis of 1 gave gymnoprenol-A.



1 (R_1=R_2=R_3=H)
2 (R_1=CH_3;R_2=R_3=H)
3 (R_1=CH_3;R_2=R_3=Ac)
4 (R_1=CH_3;R_2=Ac;R_3=H)



7



8

Methylation of gymnopilin 1 with CH_2N_2 afforded a methyl ester 2;rt (HPLC), 9.2 min; pmr, 3.67 (3H, s). Acetylation of 2 gave diacetate 3; pmr, 1.96 (3H, s), 2.06 (3H, s) and 3.67 (3H, s) along with monoacetate 4. Oxidative cleavage of the diacetate 3 by successive treatment with OsO_4 and $NaIO_4$ yielded hemiacetals 5 and 6, which could be separated by Florisil chromatography and HPLC. The hemiacetal 6 was converted to γ-lactone 8 which was identical with the γ-lactone obtained from gymnoprenol-A by oxidative fission. The hemiacetal 5 (pmr, 5.50, 1H, m) was also oxidized to γ-lactone 7 by Jones reagent. The γ-lactone 7 ;ms (HREI), m/e 403.1567 (M^++1 of $C_{18}H_{26}O_{10}$) shows pmr ($CDCl_3$) signals at 1.44 (3H, s) and 1.62 (3H, s) due to methyl groups to which carbon bearing oxygen was attached, 3.67 (3H, s, methyl ester), 2.09 , 1.99 (3H each, acetyl groups) and 3.05 (4H, s, methylenes).

The above results revealed that gymnopilin is a half-ester of β-methyl-β-hydroxyglutaric acid with gymnoprenol-A and is represented by structure 1. The absolute configuration at the chiral centers in 1 is under investigation.

Acknowledgement: The author wish to thank Prof. W.Steglich, Universität Bonn, for providing us the fruiting bodies of G.spectabilis collected in Germany.

References and Notes

1) S.Nozoe, Y.Koike, E.Tsuji, G.Kusano and H.Seto, preceding paper in this issue.
2) Lichrosorb RP-8, MeOH-H_2O 80:20 v/v%, 1.0 ml/min, 190 kg/cm^2.
3) NMR spectra were taken in CD_3OD solution unless otherwise stated.
4) The same compound has been obtained by Prof. T.Matsumoto of Hokkaido University. We thank him for giving us valuable informations.

(Received in Japan 20 January 1983)