Tetrahedron Letters No. 6, pp. 613-616, 1966. Pergamon Press Ltd.
Printed in Great Britain.

PYXINIC ACID, A NOVEL LICHEN TRITERPENE
WITH 3-β-HYDROXYL FUNCTION

Itiro Yosioka, Akiko Matsuda and Isao Kitagawa
Faculty of Pharmaceutical Sciences, Osaka University
Toyonaka, Osaka, Japan

(Received 14 December 1965)

The triterpenoids having hopane skeleton hitherto isolated from lichens, such as zeorin1), leucotylin2) and leucotylic acid3), have been characterised by lacking oxygen function at C-3. However, the study on acidic component of a lichen, Pyxine endochrysina NYL., have made it possible to isolate a new triterpenoid belonging to hopane group with a hydroxyl function at C-3. The present communication deals with the structure of the acid, now named as pyxinic acid.

Pyxinic acid (I), $C_{30}H_{50}O_4$, mp. 254-5°, $[\alpha]_D$ +62° (c = 0.3, EtOH), ν_{max}^{nujol} 3560, 3500, 1705 cm^{-1}, showed a positive Liebermann-Burchard color test and negative to tetranitromethane, and gave a methyl ester (II), $C_{31}H_{52}O_4$, mp. 285°, $\nu_{max}^{CCl_4}$ 3600, 3530, 1725, 1245 cm^{-1}. On acetylation with any of the following reagents (Ac_2O-pyridine, Ac_2O-AcONa, Ac_2O-p-TsOH) II yielded a monoacetyl methyl ester (III), $C_{33}H_{54}O_5$, mp. 257°, $\nu_{max}^{CCl_4}$ 3530, 1730, 1240 cm^{-1}, τ^*: 9.19 (Me), 9.16 (3Me), 9.08 (Me), 9.06 (Me), 8.70 (Me), 7.97 (Ac), 6.23 (OMe), 5.5 ($-\overset{|}{C}\underline{H}$-OAc). The existence of 3β-hydroxyl group was substantiated by the following evidences. Oxidation of II with chromic anhydride-pyridine complex afforded

---

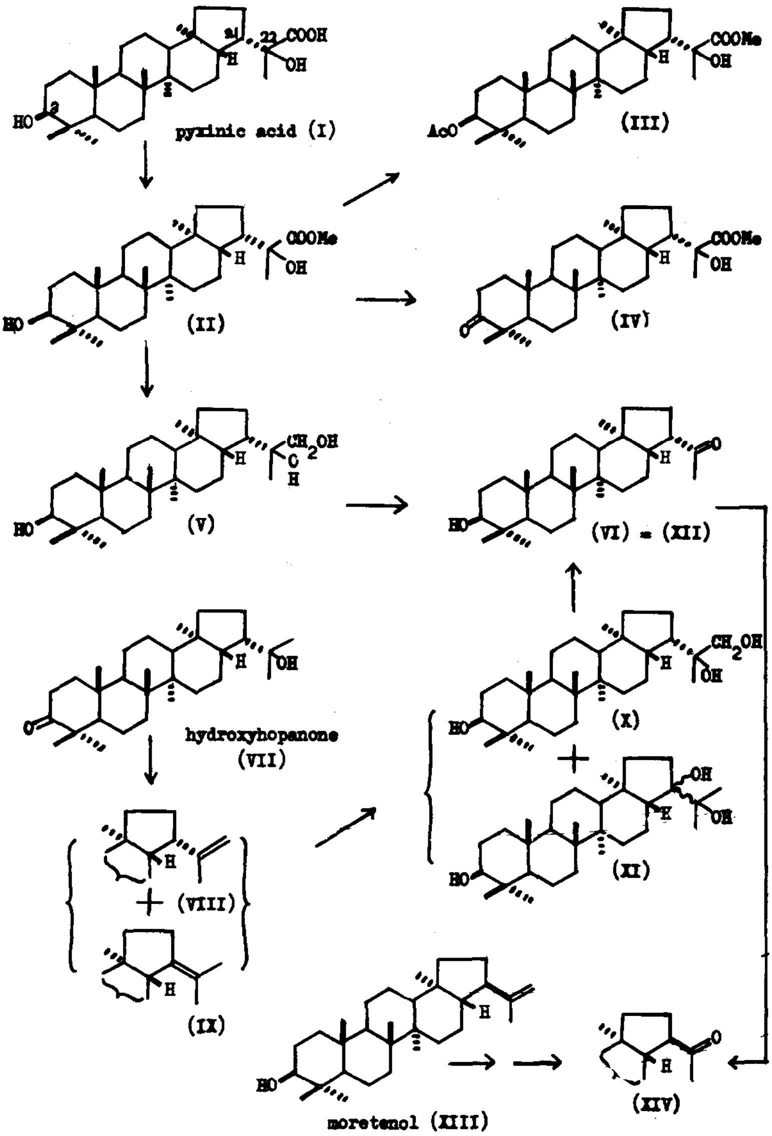
* Unless mentioned otherwise, the NMR spectra were taken in $CDCl_3$ solution and the signals were designated in τ value using TMS as an internal standard.

a monoketone (IV), which exhibited a positive Zimmermann color test suggesting the presence of a hydroxyl function at C-3 in I. As described above, a signal pattern (1H, quartet centered at τ 5.5 with $J_{ax/ax}$ ca. 8 cps, $J_{ax/eq}$ ca. 3 cps) due to a proton on a carbon bearing an acetoxyl group, disclosed the proton to be axial. The other oxygen function could be ascribed to a tertiary hydroxyl on the basis of acetylation and oxidation of II and NMR spectrum of III.

$LiAlH_4$ reduction of II gave a triol (V), $C_{30}H_{52}O_3$, mp. 234-6°. ν_{max}^{nujol} 3520, 3430, 3360 cm^{-1}, which could be transformed into a monoacetonide. A 1,2-glycol system in V was elucidated by forming a norketone (VI), $C_{29}H_{48}O_2$, mp. 214-5°, ν_{max}^{KBr} 3400, 1700 cm^{-1}, using $Pb(OAc)_4$ in dry benzene[4], thus proving an α-hydroxycarboxylic moiety in I.

In addition to the chemical reactions and spectroscopic data mentioned above (especially a singlet at τ 8.70 for a methyl in III), assuming the possible carbon skeleton of pyxinic acid to belong the hopane group similar as known lichen triterpenoids such as zeorin[1], leucotylin[2] etc., the structure (I) would be an appropriate provisional formula of pyxinic acid. The correctness of which was attained by the reaction sequence shown below.

Following the procedure started from hydroxyhopanone (VII) to a norketone done by Jones et al.[4], the derivation of VII into a norketone (XII) was accomplished. Thus, dehydration of VII using phosphorus oxychloride in pyridine produced a mixture of hopenone-b and -a (VIII and IX), which on treatment with OsO_4 followed by reduction with $LiAlH_4$ yielded two triols, X and XI (main product). The discrimination between them was made by comparing Rf values (TLC) of them and their acetates, and the subsequent chromatographic separation of them was done successfully. When X was subjected to $Pb(OAc)_4$ oxidation under the same condition as for the oxidative cleavage of V, 3β-hydroxynorhopan-22-one (XII), $C_{29}H_{48}O_2$, mp. 215-6°, ν_{max}^{KBr} 3400, 1700 cm^{-1}, was obtained.


pyxinic acid (I)
3
21
22
COOH
OH
HO
H
(II)
COOMe
(III)
AcO
(IV)
(V)
CH2OH
C
H
(VI) = (XII)
hydroxyhopanone (VII)
(VIII)
(IX)
(X)
(XI)
moretenol (XIII)
(XIV)

The identity of VI and XII was proved by comparison of their mp. (mixed mp.), IR (KBr), and TLC. Furthermore, the treatment of VI (= XII) under acidic condition isomerising to the more stable norketone (XIV), mp. 265-7°, known as a derivative of moretenol5) (XIII), afford an additional support for an unstable α-configuration of side chain at C-21 in pyxinic acid (I).

The absolute configuration at C-22 is left for the future study.

Acknowledgements: We are grateful to Prof. Emeritus Y. Asahina for identification of the lichen, to Mr. M. Togashi of Takeda Chemical Industries for helping us to collect it, and also to Dr. Y. Tsuda of this university for his generous gift of hydroxyhopanone.

REFFERENCES

1) D.H.R.Barton, P.de Mayo, J.C.Orr: *J.Chem.Soc.*, *1958*, 2239.
S.Huneck, J-M.Lehn: *Bull.soc.chim.Fr.*, *1963*, 1702.

2) I.Yosioka, T.Nakanishi: *Chem.Pharm.Bull.(Tokyo)*, *11*, 1468(1963).

3) I.Yosioka, T.Nakanishi: *The Abstracts of 8th Japanese Symposium on the Chemistry of Natural Products* (Nagoya, Oct. 22nd, 1964), pp. 143. Submitted to *Tetrahedron Letters*, Dec., 1965.

4) G.V.Baddeley, T.G.Halsall, E.R.H.Jones: *J.Chem.Soc.*, *1961*, 3891.

5) M.N.Galbraith, C.J.Miller, J.W.L.Rawson, E.Ritchie, J.S.Shannon, W.C.Taylor: *Aust.J.Chem.*, *18*, 226(1965).