Tetrahedron Letters No. 13, pp. 16-19, 1959. Pergamon Press Ltd. Printed in Great Britain.

THE RELATION OF FABACEIN TO CUCURBITACIN B

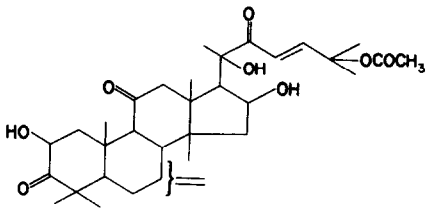
W. Schlegel and C. R. Noller

Dept. of Chemistry and Chemical Engineering, Stanford University,

Stanford, California

(Received 27 July 1959)

TWO crystalline compounds have been isolated from Echinocyctis fabacea, cucurbitacin B and fabacein.[1] Cucurbitacin B appears to have the molecular formula $C_{32}H_{46}O_8$, and structural formula I recently has been proposed for it.[2] Fabacein originally was assigned the molecular formula $C_{30}H_{44}O_8$.[1]



I

[1] W. O. Eisenhut and C. R. Noller, J. Org. Chem. 23, 1984 (1958).

[2] We wish to thank Dr. P. R. Enslin for a copy of a communication submitted to Chem. & Ind. by D. Lavie, Y. Shvo, D. Willner, P. R. Enslin, J. M. Hugo and K. B. Norton in which this formula is proposed.

We wish now to report that fabacein is a diacetate having the molecular formula $C_{34}H_{48-50}O_9$, the original analyses agreeing equally well with this formula (Calc. for $C_{34}H_{48}O_9$: C, 67.98; H, 8.05; for $C_{34}H_{50}O_9$; C, 67.75; H, 8.36. Found: C, 67.56; H, 8.23; average of 10 analyses). Like cucurbitacin B, fabacein contains an α,β-unsaturated carbonyl group and at least one free hydroxyl group.[1] Moreover, 1.3 moles of hydrogen are absorbed on catalytic hydrogenation in ethanol using palladium-on-carbon catalyst to give two products which readily can be separated. One product is dihydrofabacein (Calc. for $C_{34}H_{50}O_9$: C, 67.75; H, 8.36; for $C_{34}H_{52}O_9$: C, 67.52; H, 8.67. Found: C, 67.70; H, 8.33); m.p. 177-179° from acetone-ether-hexane; $[\alpha]_D^{25}$ + 24.0° (c = 1.35);[3] UV, λ_{max} 285 mμ, log ε 2.39;[3] IR, 2.90 (OH) 5.75-5.79 (OAc), 5.85 (C=O), 8.05 (OAc).[3] The second product could not be crystallized, but its paper chromatogram indicated that it was homogeneous. Analysis showed that it is a dihydromonodeacetoxyfabacein (Calc. for $C_{32}H_{48}O_7$: C, 70.56; H, 8.88; for $C_{32}H_{50}O_7$: C, 70.30; H, 9.22. Found: C, 70.26; H, 8.83); $[\alpha]_D^{25}$ + 17.6° (c = 1.42); UV, λ_{max} 286 mμ, log ε 2.32; IR, 2.90 (OH), 5.78 (OAc), 5.85-5.89 (C=O), 8.05 (OAc). These products are analogous to those obtained by the hydrogenation of cucurbitacin B.[4]

Acetylation of fabacein and its hydrogenation products with acetic anhydride in pyridine gave only amorphous products which were purified by

---

[3] All rotations and IR spectra are taken in chloroform and all UV spectra in ethanol.

[4] A. Melera, W. Schlegel, and C. R. Noller, J. Org. Chem. 24, 291 (1959).

passing through a chromatographic column. Each of the acetylated products was different from the corresponding product from cucurbitacin B. Fabacein gave an amorphous tetraacetate (Calc. for $C_{38}H_{52}O_{11}$: C, 66.65; H, 7.65; for $C_{38}H_{54}O_{11}$: C, 66.45; H, 7.92. Found: C, 66.52; H, 8.05); $[\alpha]_D^{25}$ -2.0° (c = 1.76); UV, λ_{max} 229 mμ, log ε 4.24 and 289 mμ, log ε 2.49; IR, 2.95 (OH), 5.80 (OAc), 5.92, 6.15 (C=C-C=O), 8.05 (OAc). Dihydrofabacein also gave an amorphous tetraacetate (Calc. for $C_{38}H_{54}O_{11}$: C, 66.45; H, 7.92; for $C_{38}H_{56}O_{11}$: C, 66.25; H, 8.20. Found: C, 66.08; H, 8.19); $[\alpha]_D^{25}$ -8.0° (c = 1.35); UV, λ_{max} 282 mμ, log ε 2.49; IR, 2.95 (OH), 5.80 (OAc), 5.90 (C=O), 8.10 (OAc). The dihydromonodeacetoxyfabacein gave an amorphous triacetate (Calc. for $C_{36}H_{52}O_9$: C, 68.76; H, 8.34; for $C_{36}H_{54}O_9$: C, 68.54; H, 8.63. Found: C, 68.72; H, 8.70); $[\alpha]_D^{25}$ -13° (c = 1.15); UV, λ_{max} 287 mμ, log ε 2.37; IR, 2.95 (OH), 5.80 (OAc), 5.90 (C=O), 8.10 (OAc).

Oxidation of the acetylated dihydrodeacetoxyfabacein with chromium trioxide in acetic acid at room temperature gave a volatile acid identified as isocaproic acid by gas chromatography. The components of the neutral fraction from the oxidation were the same as those obtained by the oxidation of acetylated dihydrodeacetoxycucurbitacein B, the chief products being the ketones A and B.[4] Thus it appears that the difference between cucurbitacin B and fabacein lies in the structure of the side chain, although the carbon skeleton of isocaproic acid is present in both.

Other differences in the behavior of fabacein and cucurbitacin B have been observed. Thus cucurbitacin B undergoes rearrangement on acetylation as shown by the fact that hydrogenation of the tetraacetate gives a single amorphous product which is not identical with the product of acetylation of dihydrocucurbitacin B but is isomeric with it (Calc. for $C_{38}H_{54}O_{11}$: C,

66.45; H, 7.92; for $C_{38}H_{56}O_{11}$: C, 66.26; H, 8.19. Found: C, 66.25; H, 8.26); $[\alpha]_D^{25}$ + 3.5° (c = 1.49); UV, λ_{max} 286 mμ, log ε 2.43; IR 2.90 (OH), 5.80 (OAc), 5.90 sh (C=O), 8.10 (OAc). Hydrogenation of the tetraacetate of fabacein gives two products which are identical with acetylated dihydrofabacein and acetylated dihydrodeacetoxyfabacein. Moreover, the oxidations of these two compounds with chromium trioxide at room temperature do not yield carbon dioxide whereas the corresponding derivatives of cucurbitacin B do.

Acknowledgment - This investigation was supported (in part) by a PHS research grant, RG-5076, from the National Institute of Health, U.S. Public Health Service.