Tetrahedron Letters No. 14, pp 1115 - 1116, 1976. Pergamon Press. Printed in Great Britain.

NERIUMOSIDES, CARDENOLIDE PIGMENTS IN THE ROOT BARK OF NERIUM ODORUM

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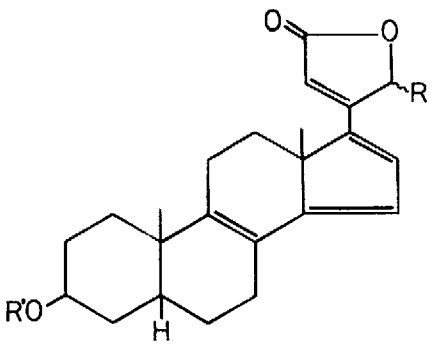
(Received in Japan 28 January 1976; received in UK for publication 24 February 1976)

Several yellow pigments were isolated from the fresh root bark of Nerium odorum and named neriumosides A-1, B-1, C-1, A-2, and B-2, in order of decrease of polarity. They are all glycosides, composed of glucose and digitalose (A-1, A-2, B-1, and B-2) and glucose and diginose (C-1), along with aglycones. The structures of sugar moieties were established as β-gentiobiosyl-(1→4)-D-digitalose (odorotriose) in A-1 and B-1, β-D-glucosyl-(1→4)-D-digitalose (odorobiose) in A-2 and B-2, and β-gentiobiosyl-D-diginose (neritriose) in C-1, according to enzymic cleavage of glucose from A-1 and B-1 to give A-2 and B-2, respectively, and to the comparisons of the sugar or sugar acetates obtained by the hydrolysis of C-1 or the acetolysis of A and B, with authentic neritriose and odorobiosyl acetate prepared from uzarigenin odorobioside[1] and -neritrioside (odoroside K)[1,2] and with gentiobiosyl acetate.



Neriumoside

A-1 : R= OH, R'= β-gentiobiosyl-(1→4β)-D-digitalosyl
[acetate : m.p. 170-178°, $[\alpha]_D$ +133°]

A-2 : R= OH, R'= β-D-glucosyl-(1→4β)-D-digitalosyl
[acetate : m.p. 226-230°, $[\alpha]_D$ +166°]

B-1 : R= H, R'= β-gentiobiosyl-(1→4β)-D-digitalosyl
[acetate : m.p. 187-188°, $[\alpha]_D$ +120°]

B-2 : R= H, R'= β-D-glucosyl-(1→4β)-D-digitalosyl
[acetate : m.p. 250-254°, $[\alpha]_D$ +205°]

C-1 : R= H, R'= β-gentiobiosyl-β-D-diginosyl
[acetate : m.p. 125-126°, $[\alpha]_D$ +91°]

Agl-1 : R= R'= H

Agl-2 : R= OH, R'= H

Aglycone of B and C [Agl-1 : m.p. 184-186°, MS : m/e 352(M^+); NMR : δ (ppm) (C_5D_5N) 6.88(1H,d, J=2Hz), 6.28(1H,d,J=2), 6.24(1H,s), 5.16(2H,dd), 4.20(1H,m), 1.22(3H,s), 1.12(3H,s)], was regarded to have genuine structure, showing the same absorption maxima as those of B and C at 245 and 387nm, and determined the structure as 3β-hydroxy-5β-carda-8,14,16,20(22)-tetraenolide, by the direct comparison with the authentic sample, obtained on the hydrolysis of Δ^{16}-dehydroadynerin.[3]

A-1 and A-2 indicate absorption maxima at 245 and 393nm, the latter of which exhibited bathochromic shift to 400nm on acetylation. Aglycone [Agl-2: m.p. 270-275°, $[\alpha]_D$ +384°, M^+ 368.196, Calcd. for $C_{23}H_{28}O_4$ 368.175; δ(C_5D_5N): 7.40(1H,d,J=2),6.70(1H,s),6.30(1H,d,J=2),6.20(1H,s),4.15(1H,m), 1.20(3H,s),1.09(3H,s)], obtained on the acid hydrolysis of A-2, also indicates the same absorption pattern as those of A-1 and A-2. Agl-2 diacetate [M^+ 452.219, Calcd. for $C_{27}H_{32}O_6$ 452.220; δ($CDCl_3$): 7.13 (1H,?),6.64(1H,d,J=2),6.13(1H,d,J=2),5.80(1H,s),4.90(1H,m),2.11(3H,?),1.99(3H,s),1.18(3H,s),1.06(3H, s)] splitted one acetyl residue by heating with pyridine to yield monoacetate [M^+ 410.184, Calcd. for $C_{25}H_{30}O_5$ 410.209; δ($CDCl_3$): 7.10(1H,d,J=2),6.24(1H,s),6.18(1H,d,J=2),5.76(1H,s),4.95(1H,m),2.02(3H, s),1.21(3H,s),1.08(3H,s)]. Monomethyl ether was formed on reflux of Agl-2 with methanolic HCl [M^+ 382.215, Calcd. for $C_{24}H_{30}O_4$ 382.214; δ($CDCl_3$): 7.04(1H,d,J=2),6.22(1H,d,J=2),6.08(1H,?),5.84(1H, s),3.50(3H,s),1.25(3H,s),1.13(3H,s)]. A broad singlet for one proton at δ 6.70 observed in Agl-2 is collapsed to double lines at δ 7.13, as well as in one of the acetyl methyl groups at δ 2.11 in Agl-2 diacetate. From these chemical and physical properties, the structure of Agl-2 was proposed as 21-hydroxy-Agl-1, and finally confirmed by the conversion of Agl-2 into Agl-1 with $NaBH_4$ in aq.EtOH[4] and of Agl-1 into Agl-2 with SeO_2 oxidation.

Since A-1 and A-2 were also transformed to B-1 and B-2 respectively, with $NaBH_4$ reduction, the sugars in A-1 and A-2 attach to 3-OH of Agl-2. The linkage between sugars and aglycones are all designated as β, according to $[M]_D$ difference (-327°) of Agl-1 and its diginoside (C-3), and to a doublet of an anomeric proton at δ 4.17 with a spacing of 8Hz in Agl-2 diginoside (A-3). Consequently, the structures of C-1 and B-1 are respectively represented as 3β-hydroxy-5β-carda-8,14,16,20(22)-tetraenolide 3-O-β-gentiobiosyl-β-D-diginoside, and -3-O-β-gentiobiosyl-(1→4β)-D-digitaloside, while A-1 is assigned the structure as 3β,21-dihydroxy-5β-carda-8,14,16,20(22)-tetraenolide 3-O-β-gentiobiosyl-(1→4β)-D-digitaloside.

Acknowledgement The authors are indebted to assist. professors K. Mihashi and H. Okabe and Mr. M. Nishi of this university for NMR and MS measurements.

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