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# TWO NEW DITERPENOID ALKALOIDS FROM *DELPHINIUM CARDIOPETALUM*

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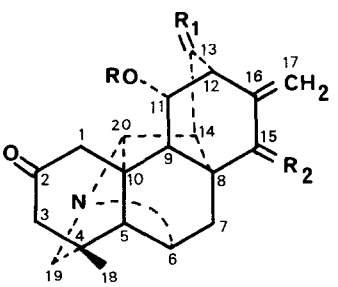
SUMMARY. The structures of cardiopetamine and 15-acetylcardiopetamine, two new C-20 diterpenoid alkaloids of the atisine type, isolated from *Delphinium cardiopetalum*, were determined by spectroscopic, chemical and X-ray data.

Further work on plants of *Delphinium cardiopetalum* DC[1,2] has resulted in the isolation of two new C-20 diterpenoid alkaloids of the atisine type, cardiopetamine (1) and 15-acetylcardiopetamine (2).




1 R=Bz, $R_1$=$R_2$=βOH,αH

2 R=Bz, $R_1$=βOH,αH, $R_2$=βOAc,αH

3 R=Bz, $R_1$=$R_2$=βOAc,αH

4 R=H, $R_1$=$R_2$=βOH,αH

5 R=Bz, $R_1$=βOH,αH, $R_2$=O

6 R=Bz, $R_1$=O, $R_2$=βOH,αH

7 R=Bz, $R_1$=O, $R_2$=βOAc,αH

Cardiopetamine had m.p. 302-305°C (decomp.), $\{\alpha\}_D$ + 65 (c, 1.4, EtOH) and analyzed for $C_{27}H_{29}NO_5$ by HRMS, the base peak being the molecular ion[3]. IR (KBr), 3440 (OH), 1710, 1285 and 720 (benzoate), 1700 (cyclohexanone), 1650 and 870 $cm^{-1}$ ($C=CH_2$). $^1$H-NMR ($CDCl_3$), δ1.13 (3H, *s*, $C-CH_3$), 3.94 (1H, *bs*, C-15αH), 4.12 (1H, *bd*, *J*= 9Hz, C-13αH), 5.18 (2H, *bs*, $C=CH_2$), 5.64 (1H, *d*, *J*= 9Hz, C-11βH), 7.54 and 8.08 (3H and 2H, *m*, benzoate). UV, $\lambda_{max.}^{EtOH}$ 299 nm (ε= 57).

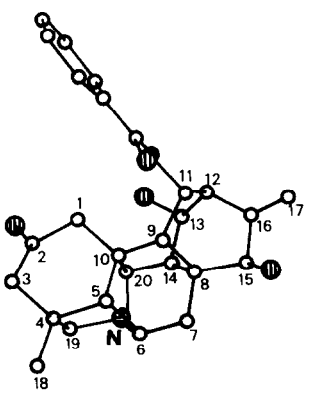
15-Acetylcardiopetamine, m.p. 236-7°C, $\{\alpha\}_D$ + 12 (c, 0.51, EtOH). HRMS, $M^+$ (100%), $C_{29}H_{31}NO_6$. IR (KBr), 3425 (OH), 1735 and 1230 (acetate), 1710 1285 and 720 (benzoate), 1700 (cyclohexanone) and 1650 $cm^{-1}$ ($C=CH_2$). $^1$H-NMR ($CDCl_3$), δ1.10 (3H, *s*, $C-CH_3$), 2.15 (3H, *s*, acetate), 4.16 (1H, *bd*, *J*= 9Hz, C-13αH), 5.20 (1H, *bs*, C-15αH), 5.30 and 5.37 (1H each, *bs*, $C=CH_2$), 5.63 (1H, *d*, *J*= 9Hz, C-11βH), 7.54 and 8.08 (3H and 2H, *m*, benzoate).

By acetylation with $Ac_2O$/Py , compounds (1) and (2) gave the same diacetate (3) as a resin, $M^+$ 531 (100%), $^1$H-NMR ($CDCl_3$), δ2.13 and 2.30 (3H each, *s*, acetate), 5.12 (1H, *bd*, *J*= 9Hz, C-13αH), 5.27 (1H, *bs*, C-15αH), 5.37 (2H, *bs*, $C=CH_2$) and 5.60 (1H, *d*, *J*= 9Hz, C-11βH). Hydrolysis of (1) and (2) with 5% KOH in MeOH afforded the same aminoalcohol (4), m.p. 306-308°C (decomp.), $M^+$ 343 (100%), $^1$H-NMR ($CDCl_3$-$CD_3OD$), δ3.79 (1H, *bs*, C-15αH), 4.02 (1H, *bd*, *J*= 9Hz, C-13αH), 4.40 (1H, *d*, *J*= 9Hz, C-11βH) and 5.09 (2H, *bs*, $C=CH_2$).

Oxidation of (1) with Cornforth's reagent at 25°C led to an α,β-unsaturated ketocompound (5) in 48% yield, m.p. 275-278°C, $M^+$ 445 (100%), IR (KBr) 1690 and 1635 $cm^{-1}$, UV, $\lambda_{max.}^{EtOH}$ 230 nm (ε= 10.560), $^1$H-NMR ($CDCl_3$), δ4.38 (1H, *bd*, *J* = 9Hz, C-13αH), 5.37 (1H, *d*, *J*= 9Hz, C-11βH), 5.31 and 6.07 (1H each, *s*, $C=CH_2$); and a β,γ-unsaturated ketocompound (6) in 36% yield, m.p. 252-255°C, $M^+$ 445 (30%), IR (KBr) 1700 and 1650 $cm^{-1}$, UV, $\lambda_{max.}^{EtOH}$ 303 nm (ε= 108), $^1$H-NMR ($CDCl_3$), δ4.18 (1H, *bs*, C-15αH), 5.30 (2H, *bs*, $C=CH_2$) and 5.80 (1H, *d*, *J*= 9Hz, C-11βH).

Treatment of (6) with AcO/Py or (2) with Cornforth's reagent afforded compound (7), m.p. 253-256°C (decomp.), $M^+$ 487 (45%), UV, $\lambda_{max.}^{EtOH}$ 303 nm ($\varepsilon$= 160), $^1$H-NMR ($CDCl_3$), δ2.18 (1H, *s*, acetate), 5.38 (1H, *bs*, C-15αH), 5.54 (2H, *bs*, $C=CH_2$) and 5.73 (1H, *d*, *J*= 9Hz, C-11βH).

The above chemical and spectroscopic data and biogenetic considerations placed cardiopetamine among the hetisine subtype alkaloids[4] possessing a carbonyl group, a hydroxy group at C-15βH, and a benzoyloxy and a hydroxy group either at C-11α or C-13β. Single crystals were obtained from petrol ether-ethyl acetate and the structure was determined by X-ray diffraction analysis. Cardiopetamine crystallized in the orthorhombic system, space group $P2_12_12_1$, with $\underline{a}$ = 7.662(3), $\underline{b}$ = 15.687(5), $\underline{c}$ = 18.286(7)Å, $\underline{U}$ = 2918Å$^3$, and $\underline{Z}$ = 4. The structure was solved by direct methods and refined to $\underline{R}$ = 0.057 and $\underline{R}_w$ = 0.055 for 2318 reflections with $\underline{F}>3\sigma(\underline{F})$ (Cu$\underline{K}\alpha$ radiation, $2\Theta_{max.}$ 120°). The absolute configuration could not be determined crystallographically.



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## R E F E R E N C E S

1 A.G. González, G. de la Fuente, M. Reina, V. Zabel and W.H. Watson, *Tetrahedron Letters*, 21, 1155 (1980).

2 A.G. González, G. de la Fuente and M. Reina, *Anal. Quím.*, 77, C, 171 (1981).

3 S.D. Sastry in "Biochemical Applications of Mass Spectrometry", ed.: G.R. Waller, J. Wiley, New York (1972), p.664.

4 S.W. Pelletier and N.V. Mody in "The Alkaloids", ed.: R.H.F. Manske and R. Rodrigo, Academic Press Inc., New York (1981), vol. 18, p.122.

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