PARTIE EXPERIMENTALE

Alcaloïde **4** Δ14 *isoéburnamine* $C_{19}H_{22}ON_2$. Non cristallisé; UV λ_{max} (log ε) 229 (4.35), 275 (3.79), 282 (3.80), 290 (3.70); RMN ($CDCl_3$): *t* (3H) 1.0, *q* (2H) 1.70, *s* (OH) 2.93, *s* H21 4.07, *m* (2H) 5.75, *t* H16 5.85; SM: M^+ 294, principaux pics à *m/e* 265, 247, 226, 208, 180, 170, 144, 143, 122, 121.

Alcaloïde **5** *mélonine* $C_{19}H_{26}N_2$. Cristallisation du chlorhydrate F 262°; base $[\alpha]_{580}^{22}$ +82° ($CHCl_3$); UV λ_{max} (log ε) 248 (3.80), 298 (3.45); RMN ($CDCl_3$): *t* (3H) 0.85, *q* (2H) 1.33, *s* N_a–H 4.26, *d* (H) 6.62 *t* (H) 6.78, *m* (2H) 7.0; SM: M^+ 282, principaux pics à *m/e* 281, 254, 253, 225, 210, 152, 144, 143, 138, 130, 124, 110; DC (EtOH) 298 (−1.10), 248 (+3.22).

Alcaloïde **6** N_b-*oxy mélonine* $C_{19}H_{26}ON_2$. Cristallisé dans l'acétone; UV λ_{max}(log ε) 247 (3.82), 298 (3.31); RMN ($CDCl_3$): *t* (3H) 0.83, *q* (2H) 1.27, *s* N_a–H 4.21, *d* (H) 6.58, *t* (H) 6.73, *m* (2H) 7.00; SM: M^+ 298, principaux pics à *m/e* 282, 281, 249, 224, 210, 170, 157, 156, 152, 144, 143, 138, 124, 110.

Alcaloïde **7** *Méthylène bis*-1,1′*mélonine*. Cristallisé à l'état de dichlorhydrate $C_{39}H_{54}N_4Cl_2$ dans l'acétone; $[\alpha]_{580}^{22}$ +71° ($CHCl_3$); UV λ_{max} (log ε) 248 (3.82), 298 (3.37); RMN (D_2O): *t* (3H) 0.87, système AB 5.08 et 5.15 (11 Hz), *m* (8H) 6.5 à 7.2; SM: M^+ 576, principaux pics à *m/e* 547, 543, 518, 504, 295, 281, 249, 224, 210, 170, 152, 144, 143, 138, 130, 124, 110.

L'alcaloïde **7**. Baptisé buxoméline $[\alpha]_{580}^{22}$ −240° ($CHCl_3$) obtenu à l'état amorphe a pour formule brute $C_{21}H_{22}O_4N_2$; son spectre UV (EtOH) présente des maximas d'absorption à λ_{max} (log ε) 297 (4.95) et 330 (4.21) caractéristiques du chromophore carbométhoxy α-méthylène indoline et la présence du pic de base à *m/e* 214 sur le spectre de masse caracterise l'enchainement A non substitué.

La séquence $Me\overset{18}{}CH\overset{19}{}C\overset{20}{}$ est mise en évidence par l'existence d'un doublet à 1.05 ppm. et d'un quadruplet à 3.98 ppm. sur le spectre de RMN du proton ainsi que par la présence des fragments $(M-28)^+$ et $(M-44)^+$ en SM. L'enchaînement $N—CH_2^3—CH\overset{15}{=}CH\overset{14}{}C\overset{20}{}$ est établi grâce à l'irradiation des quatre protons et l'observation des découplages qui en résultent; ces expériences ayant permis l'élucidation complète de cette partie du spectre: H14 *ddd* 5.72 ppm. J_{14-15} 9.5 Hz, $J_{3\alpha-14}$ 3 Hz, $J_{3\beta-14}$ 0.5 Hz; H15 *ddd* 6.15 ppm. J_{14-15} 9.5 Hz, $J_{3\alpha-15}$ 1.5 Hz, $J_{3\beta-15}$ 1 Hz; H3α *ddd* 3.73 ppm. J_{gem} 15 Hz, $J_{3\alpha-14}$ 3 Kz, $J_{3\alpha-15}$ 1.5 Hz; H3β *ddd* 3.34 ppm. J_{gem} 15 Hz, $J_{3\beta-15}$ 1 Hz, $J_{3\beta-14}$ 0.5 Hz Un système AB(J = 16 Hz) à 2.29 ppm et 2.86 comparable au système observé sur le spectre de la tabersonine et de la vincoline [9] est attribué aux deux protons H17. La fonction alcool tertiaire est déduite de la présence à 3.70 ppm. d'un signal disparaissant après addition de D_2O, de la présence d'une bande IR à 3450 cm^{-1} et de l'impossibilité d'obtenir un dérivé acétylé. Dès lors il apparaît que la fonction oxygénée portée par la chaîne latérale ne peut être qu'une fonction éther. Celle-ci ne peut s'établir qu'en 5, le pic *m/e* 214 indiquant que C6 n'est pas substitué. Quant à la fonction alcool tertiaire, sa localisation en 21 est corroborée par l'absence de signal singulet vers 2.50 ppm correspondant à H21 chez tous les alcaloïdes de ce type. Sur ces bases, la formule **2** est compatible avec l'ensemble des données spectroscopiques obtenues pour la buxomèline. La construction des modèles de Dreiding montre que la chaîne en 20 doit posséder la configuration β.

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THE ALKALOIDS OF *DELPHINIUM BROWNII*

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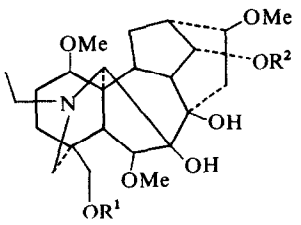
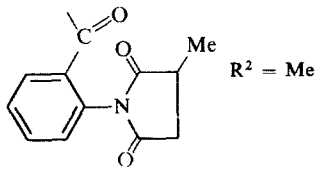
Key Word Index—*Delphinium brownii*; *D. glaucum*; Ranunculaceae; browniine, browniine acetate; methyllycaconitine; magnoflorine.

Delphinium brownii Rydb. is a tall larkspur native to the foothills of Alberta. Although preserved at the species level by Ewan [1] in his synopsis of the North American Delphinium, *D. brownii* is probably better regarded [2] as a local form of *D. glaucum* S. Wats. The plant is notorious among ranchers as a stock poison. The toxic principles are alkaloidal and previous investigations established the presence of the diterpenoid tertiary bases methyllycaconitine (**1**) [3, 4] and browniine (**2**) [4]. We have re-examined the alkaloids of *D. brownii* and now report that, in addition to **1** and **2**, browniine 14-*O*-acetate (**3**) occurs in the bases extracted from aerial portions of the plant (both early shoots, and mature flowering stages). Although this acetate has been known [4] as a synthetic derivative of browniine, this isolation demonstrates its natural occurrence [5]. The spectroscopic data which led to our identification of **3**, are outlined in the Experimental, and the identity of the alkaloid was clinched by direct comparison with semi-synthetic material.





1 R^1 = R^2 = Me

2 R^1 = Me, R^2 = H
3 R^1 = Me, R^2 = Me

We also found that *D. brownii* produced small amounts of a quaternary alkaloid, identified as the aporphine magnoflorine. This alkaloid has been reported from some other *Delphinium* species [6, 7] and we suspect that its distribution within the genus is more extensive than usually recognized, a matter which has to be taken account when attempting to interpret the poisoning produced by the plants.

EXPERIMENTAL

Mps were uncorr. IR spectra were determined in KBr discs. MS were measured at 70 eV; ^{1}H-NMR at 100 MHz; and rotations with a Durrum Jasco ORD-UV 5 spectrometer.

Isolation of browniine 14-O-acetate. The non-quaternary alkaloids were obtained from *D. brownii* by the usual procedure [4], Na_2CO_3 being used as base rather than ammonia to avoid the formation from methyllycaconitine of the artefact delsemine [8, 9]. When the alkaloids were chromatographed on a column of Al_2O_3 (Woelm, neutral, grade IV), C_6H_6–CH_2Cl_2 eluted material before browniine, which crystallized from hexane as colourless needles mp 115–116° (350 mg/kg dried plant), $[\alpha]_D^{25}$ + 37 (±3)° (EtOH), ν_{max} 3490–3400 (OH), 1735 and 1255 (MeCOO—), and 1090 (C—O—C) cm^{-1}; ^{1}H-NMR ($CDCl_3$) δ 1.02 (3H, *t*, *J* = 7 Hz; $MeCH_2N$), 2.02 (3H, *s*, MeCOO), 3.2 (3H, *s*, OMe), 3.24 (3H, *s*, OMe), 3.28 (3H, *s*, OMe), 3.4 (3H, *s*, OMe) and 4.7 (1H, apparent *t*, *J* = 5 Hz, H-14); *m/e* (prominent high mass ions only) 509 (M^+), 494 and 478 (100%).

Isolation of magnoflorine. The aq. extract remaining after removal of the basic alkaloids was processed for quaternary alkaloids after the procedure of ref. [10]. Magnoflorine (**4**) was isolated as the iodide (270 mg/kg dried plant) mp 249–251°; ^{1}H-NMR (CF_3CO_2H) δ 3.10 (3H, *s*, NMe) 3.46 (3H, *s*, NMe), 3.96 (3H, *s*, OMe), 3.98 (3H, *s*, OMe), 6.88 (1H, *s*, H-3) and 7.04 (2H, *s*, H-8, 9); *m/e* 342, 341, 327, 312, 283, 142, 127 and 58 (100%); $[\alpha]_D^{29}$ + 195(±15)° (MeOH). The ease of confusion of magnoflorine and *N,N*-dimethyllindcarpine has been the subject of recent comment [11], but our compound had an IR-spectrum superimposable upon that of the authentic alkaloid.

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