(t, J = 1.6 Hz, H-1b), 7.92 (d, J = 4.3 Hz, H-1a), 5.52 (d, J = 4.3 Hz, H-2a), 5.34 (br t, J = 5.4 Hz, H-9,10), 3.50 (d, J = 1.6 Hz, H-2b), 2.33 (t, J = 6.7 Hz, H-4), 0.88 (br t, J = 4.9 Hz, H-16); ^{13}C NMR ($CDCl_3$) δ 199.75 (s, C-3), 175.77 (d, C-1a), 130.35, 129.48 (d, d, C-9,10), 101.79 (d, C-2a), 39.55 (t, C-4), 31.85 (t, C-13), 29.78, 29.50, 29.06, 28.90, 27.30, 27.04, 25.21 (C-5–8,11,12), 22.71 (t, C-14) 14.14 (q, C-15).

Pyrazole and isoxazole derivatives were prepared as described above. Spectral data for isoxazole 8: ^{1}H NMR ($CDCl_3$) δ 8.12 (d, J = 1.7 Hz, H-1), 5.95 (d, J = 1.7 Hz, H-2), 5.34 (br t, J = 5.5 Hz), 2.77 (t, J = 7.7 Hz, H-4), 2.04–1.98 (m, H-8, H-11), 0.88 (br t, J = 5 Hz, H-16); ^{13}C NMR (C_6D_6) δ 172.51 (C-3), 149.71 (C-1), 130.29, 129.63 (C-9,10), 99.53 (C-2), 32.01 (C-14), 29.98, 29.45, 29.22, 28.72, 27.52 (×2), 27.21, 26.38 (C-4–8,11–13), 22.89 (C-15), 14.14 (C-16); electron-impact mass spectrum (70 eV), m/z (relative intensity) 249 (1), 232 (2), 220 (4), 206 (6), 192 (7), 178 (7), 96 (100), 83 (41), 70 (52), 55 (60), 41 (42).

Spectral data for pyrazole 7: ^{1}H NMR ($CDCl_3$) δ 7.47 (br d, $J \simeq 1$ Hz, H-1), 6.09 (br d, $J \simeq 1$ Hz, H-2), 5.34 (br t, J = 5.4 Hz, H-9,10), 2.67 (br t, $J \simeq 7.2$ Hz, H-4) 2.04–1.98 (br m, H-8,11), 0.88 (br t, $J \simeq 5.5$ Hz); ^{13}C NMR (C_6D_6) δ 147.82 (C-3), 134.70 (C-1), 130.14, 129.87 (C-9,10), 103.45 (C-2), 32.02 (C-14), 29.99, 29.72 (×2), 29.19 (×2), 27.49, 27.42, 26.95 (C-4–8,11–13), 22.89 (C-15), 14.14 (C-16); the resonances at δ 147.82, 134.70, and 103.45 were severely broadened due to the presence of both pyrazole tautomers; electron-impact mass spectrum (70 eV), m/z (relative intensity) 248 (3, M^+), 219 (4), 205 (19), 191 (13), 177 (17), 163 (12), 149 (16), 95 (100), 82 (95), 81 (66), 40 (38). The largest peaks are attributed to α cleavage and McLafferty-type rearrangement.[5]

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Proton and Carbon-13 Nuclear Magnetic Resonance Spectroscopy and Conformational Aspects of the Curine Class of Bis(benzylisoquinoline) Alkaloids

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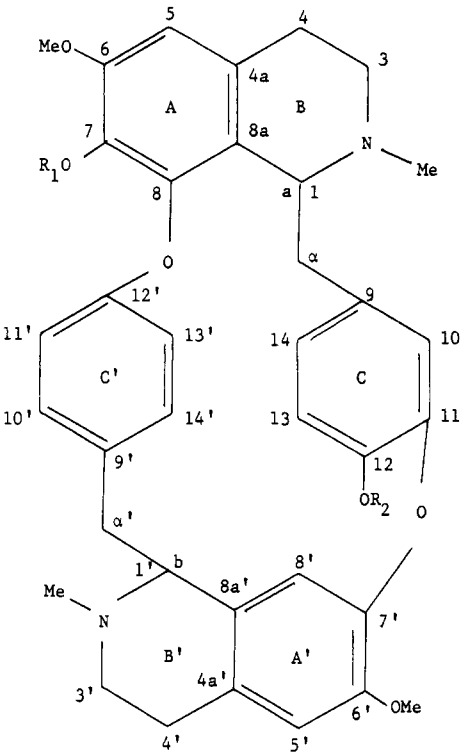
Due to the neuromuscular blocking activity shown by some members of the curine class of bis(benzylisoquinoline) alkaloids[1] much effort has been devoted to the elucidation of their structures, and more recently, by the application of modern spectroscopic techniques, data on their solution conformations have also been reported.[2]

The increasing use of ^{13}C NMR spectroscopy for structure elucidation of natural products and the lack of data on the bis(benzylisoquinolines) prompted us to analyze different classes of these alkaloids[3,4] in the hope of contributing to the determination of related but up to now unresolved structures[5] as well as to the detection, in combination with ^{1}H NMR, of conformational features of these interesting substances.

The ^{13}C NMR analyses were initiated with bebeerine (1) and its derivatives **2–7**.



1. $R_1 = R_2 = H$ (a,b = R,R)
2. $R_1 = R_2 = Me$ (a,b = R,R)
3. $R_1 = Me$, $R_2 = H$ (a,b = R,R)
4. $R_1 = H$, $R_2 = Me$ (a,b = R,R)
5. $R_1 = Me$, $R_2 = Ac$ (a,b = R,R)
6. $R_1 = Ac$, $R_2 = Me$ (a,b = R,R)
7. $R_1 = Ac$, $R_2 = Ac$ (a,b = R,R)
8. $R_1 = R_2 = H$ (a,b = R,S)

Table I lists their carbon shifts which were assigned by standard chemical shift theory and analysis of the SFORD and fully coupled spectra. Due to the overlapping of signals, the application of inversion recovery conditions was necessary to detect the sp^2 carbons nonbonded to hydrogen. The assignment was further supported by the known effects of alkylation and acetylation of phenols, analysis of model compounds, and selective irradiations.

The carbons of rings ABC and A′B′C′ were assigned, taking isochondodendrine (**9**) and 1-(*p*-methoxybenzyl)-6,7-dimethoxytetrahydroisoquinoline (**10**)[3] as models, respectively. The assignments of rings A and C′ carbons of **1** were in accordance with rings A and C of **9**, respectively, showing the same C–H nonequivalence in ring C as well. Confirmation of ring A chemical shifts was carried out by methylation, going from **1** to **2**, **3**, and/or **5**, and acetylation, going from **1** to **6** and/or **7**, of the phenols.[4–6] The

(1) Shamma, M. "The Isoquinoline Alkaloids"; Academic Press: New York, 1972; p 142.
(2) Egan, R. S.; Stanaszek, R. S.; Williamson, D. E. *J. Chem. Soc. Perkin Trans. 2* **1973**, 716. Bick, I. R. C.; Harley-Mason, J.; Sheppard, N.; Vernengo, M. J. *J. Chem. Soc. C.* **1961**, 1896.
(3) Marsaioli, A. J.; Ruveda, E. A.; Reis F. de A. M. *Phytochemistry* **1978**, *17*, 1665.
(4) Koike, L.; Marsaioli, A. J.; Ruveda, E. A.; Reis, F. de A. M.; Bick, I. R. C. *Tetrahedron Lett.* **1979**, 3765.
(5) Guha, K. P.; Mukherjee, B.; Mukherjee, R. *J. Nat. Prod.* **1979**, *42*, 1.

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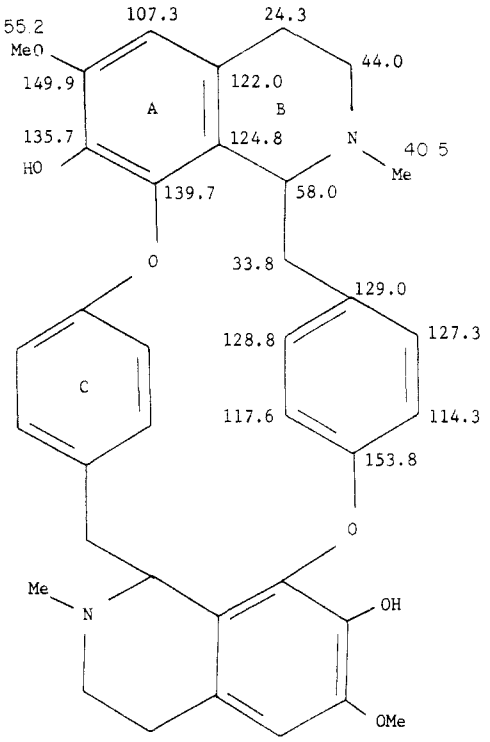

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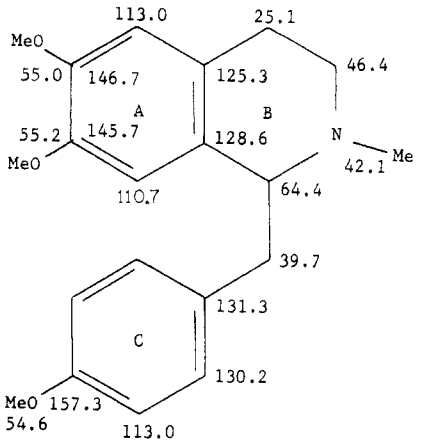

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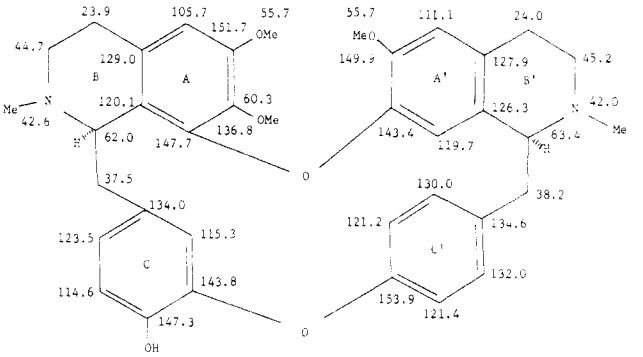
fully coupled spectrum of **1** showed C-7 at 137.3 ppm as a doublet and C-8 at 138.3 ppm as a sharp singlet, identical with the pattern reported for isochondodendrine (**9**).[3] The signals at 148.2, 143.5, 128.4, 128.4, 119.5, and 112.0 ppm were assigned to carbons 6′, 7′, 4a′, 8a′, 8′, and 5′ (ring A′) by comparison with the calculated δ values of like carbons of **10**, obtained by the predictable modifications produced by the change of a methoxy to an aryloxy substituent on C-7 (**10** → **1**).[6] Selective irradiation at the H-8′ signal (δ 6.04), which appears at higher field than those of the remaining aromatic protons, simplified that at 119.5 ppm, allowing its unambiguous assignment to C-8′. A careful analysis of the ^{1}H and ^{13}C NMR data of **1** and its derivatives **2**–**7** shows some interesting results. Methylation or acetylation of the C-12 phenol of **1** induces a clear shielding effect on C-8′, unambiguously assigned in all compounds by selective proton decoupling, and although lower in magnitude C-4a′ and C-6′ also suffer a shielding effect. The mentioned transformations (**1** to **2**, **4**, and **6** and **1** to **5** and **7**) also shift the H-8′ signals to higher field while the corresponding ones of H-14′ are shifted to lower field (Table II). [The ring C proton signals show broad absorptions similar to the one reported for (+)-tubocurarine chloride at room temperature[2] and were not assigned.]

Examination of Dreiding models shows that compound **1** has a strained structure adopting extended and folded conformations for rings ABC and A′B′C, respectively, in some way similar to the ones proposed for the berbamine class of alkaloids.[4] Consequently, the substituent effects observed on the ^{13}C and ^{1}H NMR signals could be produced by a gradual rotation of ring C leading C-12 to the external part of the molecule which adopts a less hindered conformation.

This rotation approximates H-8 and takes H-14′ away from the anisotropic shielding of ring C′ simultaneously, increasing the electron donation of the oxygen at carbon 7′ to ring A′, consequently shielding C-8′, C-6′, and C-4a′.[6]

The sp^3 carbon shifts of **1** as in **11**[4] were split into two groups, δ 64.7, 44.6, 41.3, 39.5, and 24.1 and δ 59.8, 43.6, 41.3, 39.5, and 21.6. Comparison of δ values of similar sites in both units shows that, due to the C-8 oxygen γ effect, C-1 is clearly shielded.



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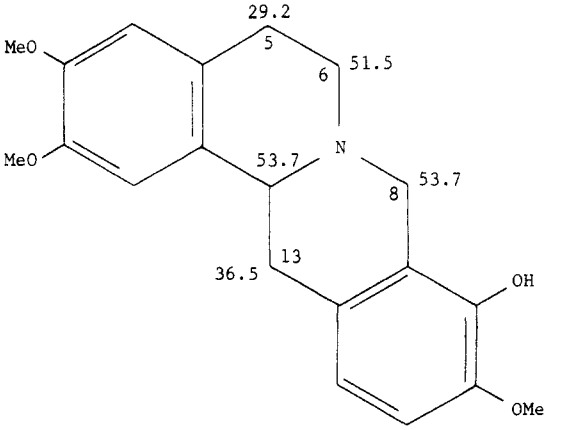
The difference between C-4 and C-4′ could be explained by assuming that in ring B the *N*-Me is preferentially pseudoaxial and therefore through a γ effect shields C-4 (21.6 ppm). Carbon 4′, on the other hand, in a ring with a predominant pseudoequatorial *N*-Me, shows a lower field signal (24.1 ppm). In the rigid system of **12**,[7] however, with



12

the pseudoequatorial N substituent (C-8), the methylene

(6) Gottlieb, H. E. *Isr. J. Chem.* **1977**, *16*, 37 and references cited therein.

(7) Kametani, T.; Fukumoto K.; Ihara M.; Ujiie A.; Koizumi H. *J. Org. Chem.* **1975**, *40*, 3280.

Table I. ^{13}C NMR Data for Bebeerine (1) and Related Alkaloids[a]

carbons	chemical shift, ppm							
	1[b]	2	3	4	5	6	7	8
1	59.8	60.3	60.2	60.2	60.4	60.6	60.2	59.3
3	43.6	43.1	43.5	43.4	43.1	43.2	42.9	44.2
4	21.6	21.6	21.9	21.4	21.6	22.1	21.5	23.2
4a	123.9[d]	129.4	129.2	124.3	129.5	132.0	132.0	124.6
5	107.7	108.7	108.8	107.7	108.8	108.7	108.4	107.7
6	146.8	151.5	151.7	146.5	151.7	150.5	150.2	146.7
7	137.3	140.1	140.4	137.0	140.3	131.2	130.9	137.2
8	138.5	145.9	144.8	138.5	145.0	144.4	144.0	137.9
8a	124.0[d]	124.2	124.2	124.3	124.1	124.3	123.7	125.4
α	39.5	38.9	39.4	39.5	39.2	39.3	38.7	40.1
9	133.2	133.9	133.4	134.1	140.5	134.0	140.1	132.6
10	120.2	122.1	120.7	121.4	121.8	122.5	121.5	121.0
11	142.8[c]	143.9	143.1	143.6	146.5	144.2	146.4	143.1
12	145.9	148.9	146.1	148.8	139.9	149.2	139.9	145.9
13	115.2	111.7	115.2	112.8	122.4	112.0	122.2	115.4
14	125.8	125.0	126.3	124.6	125.2	125.4	124.9	125.7
1′	64.7	64.9	65.2	64.7	64.6	65.1	64.8	64.4
3′	44.6	45.6	45.4	45.0	45.0	45.7	45.4	46.5
4′	24.1	25.2	24.9	24.4	24.6	25.2	25.2	25.2
4a′	128.4	126.5	128.4	126.5	127.1	126.5	127.7	128.6
5′	112.0	112.1	112.0	111.9	112.2	112.4	112.0	111.9
6′	148.2	147.8	148.4	148.3	148.3	148.1	147.9	148.0
7′	143.5[c]	143.2	143.5	143.3	143.2	143.3	142.8	143.1
8′	119.5	116.2	119.3	117.2	117.7	116.3	117.4	117.9
8a′	128.4	127.9	128.3	127.5	127.2	127.2	128.0	128.1
α′	39.5	39.4	39.7	39.5	40.1	39.6	39.9	39.0
9′	131.5	131.5	131.3	131.5	131.2	132.7	132.3	131.7
10′	131.3	131.9	132.0	131.5	131.9	132.0	131.7	132.2
11′	114.7	114.7	115.2	114.3	114.8	115.0	114.6	113.2
12′	155.2	155.2	155.6	155.0	155.4	154.7	154.4	155.4
13′	113.1	112.9	113.0	113.5	113.2	113.6	113.6	114.9
14′	129.2	129.0	129.6	129.3	129.3	129.3	129.0	129.9
NMe	41.3, 41.3	41.3, 42.1	41.5, 41.8	41.4, 41.8	41.4, 41.4	41.5, 42.1	41.1, 41.9	42.2, 42.5
OMe	55.7, 55.7	55.7, 55.7, 60.8 (C-7)	55.8, 55.8, 61.0 (C-7)	56.0, 56.0, 56.0	55.7, 55.7, 60.9 (C-7)	55.9, 55.9, 55.9	55.5, 55.5	55.8, 56.0
C=O					168.3	168.2	167.7, 168.1	
O ‖ CCH$_3$					20.3	20.1	19.6, 20.0	

[a] The spectra were obtained in $CDCl_3$ solutions. Chemical shifts are expressed on the Me_4Si scale according to the following equation $\delta^{Me_4Si} = \delta^{CDCl_3} + 76.9$ ppm. [b] Some drops of MeOH were added for better solution. [c,d] Signals within vertical column may be reversed.

Table II. ^1H NMR Data for Bebeerine (1) and Relative Alkaloids[a,b]

compd	chemical shift, ppm							
	OMe	NMe	H-5	H-5′	H-8	H-10′	H-13′	H-14′
1	3.97 (s)	2.55 (s), 2.35 (s)	6.75 (s)	6.61	6.04	6.66 (d, J = 2.0)	6.87 (d, J = 8.3)	7.03 (dd, J = 2.0, 8.3)
2	3.93, 3.91, 3.76, 3.74	2.56, 2.34	6.77	6.64	5.59	6.62 (d, J = 2.0)	6.87 (d, J = 8.3)	7.23 (dd, J = 2.0, 8.3)
3	3.95, 3.92, 3.80	2.60, 2.32	6.77	6.64	6.00	6.71 (d, J = 2.0)	6.88 (d, J = 8.3)	7.03 (dd, J = 2.0, 8.3)
4	3.92, 3.90 3.74	2.51, 2.34	6.74	6.60	5.60	6.54 (d, J = 2.0)	6.86 (d, J = 8.3)	7.23 (dd, J = 2.0, 8.3)
5	3.85, 3.82 3.70	2.52, 2.30	6.53	6.63	5.60	6.58 (d, J = 2.0)	6.91 (d, J = 8.5)	7.18 (dd, J = 2.0, 8.5)
6	3.90, 3.85, 3.70	2.55, 2.30	6.70	6.57	5.50	6.60 (d, J = 2.0)	6.78 (d, J = 8.5)	7.15 (dd, J = 2.0, 8.5)
7	3.83	2.30, 2.51	6.58	6.61	5.58	overlap	6.91 (d, J = 8.3)	7.13 (dd, J = 2.0, 8.3)

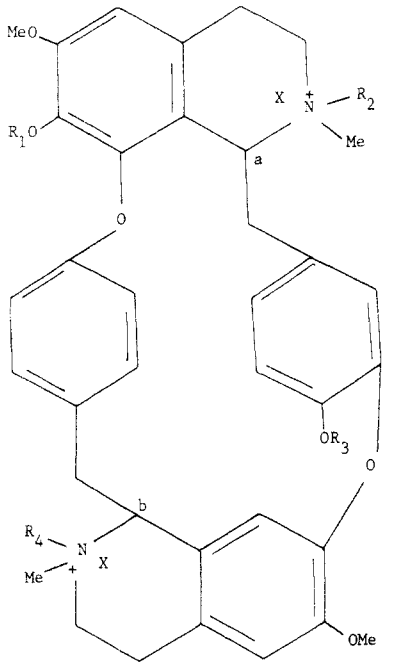
[a] The spectra were obtained in $CDCl_3$ solutions. The J values are given in hertz. [b] OAc group: 5, 2.12 ppm; 6, 2.07 ppm; 7, 2.06 and 211 ppm.

at the γ-position is completely free of its steric effect, showing an even more deshielded signal than C-4′ of 1, supporting the above arguments.

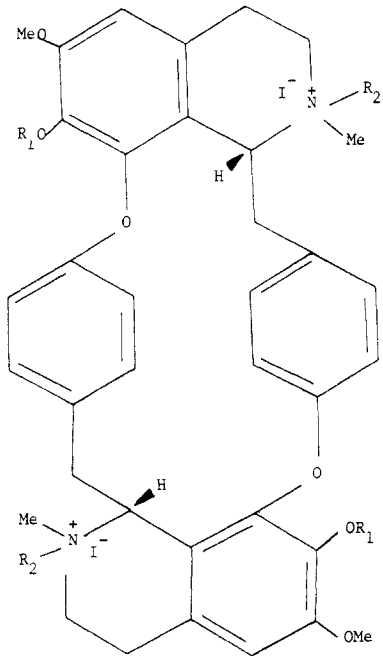
At this point, the analysis of the diastereoisomeric alkaloid chondrocurine (8), greatly facilitated by the information obtained with 1, was carried out. Comparison of both sites of chemical shifts reveals that all carbons have very similar values. For a conformational anslysis we focused our attention on C-3′ and C-8′ which are slightly deshielded and shielded, respectively, in 8.

Accepting that in both diastereoisomers ring B adopts the same predominant half-chair conformation, one can see that C-α' would be pseudoaxial in bebeerine (1) and pseudoequatorial in chondrocurine (8). The latter situations releases, at least partially, the C-α'/C-3′ interaction and increases at the same time that of C-α'/C-8′.

Quaternary bis(benzylisoquinoline) alkaloids are widely distributed in nature, and the onium function is supposed to play an important role in their pharmacological activities. In connection with problems of structure determination of compounds like (+)-tubocurarine chloride (13),



13. $R_1 = R_3 = R_4 = H$ $R_2 = Me$; $X = Cl^-$ (a,b = R,S)
14. $R_1 = R_2 = R_3 = R_4 = Me$; $X = I^-$ (a,b = R,S)
15. $R_1 = R_3 = H$ $R_2 = R_4 = Me$; $X = I^-$ (a,b = R,R)
16. $R_1 = R_2 = R_3 = R_4 = Me$; $X = I^-$ (a,b = R,R)
17. $R_1 = R_2 = R_3 = R_4 = H$; $X = Cl^-$ (a,b = R,R)



18. $R_1 = H$, $R_2 = Me$

a monoquaternary salt that was long thought a diquaternary salt,[8,9] two diastereoisomeric series of bis(benzylisoquinoline) *N*-metho salts were analyzed, and the ^{13}C NMR data are listed in Table III.

The transformation of the tertiary alkaloids into their corresponding *N*-metho salts affects all N vicinal carbons, and the observed chemical shifts can be interpreted as a net balance between electronic and steric effects. On the basis of the above arguments, it could be accepted that the second *N*-Me group (going from 1 to **15**) will be pseudoaxial in ring B′ of **15**, while the observed shielding at C-4′ is the result of a γ interaction between them (shielding) and the deshielding due to the quaternarization of the nitrogen. On the other hand, the absence of a net shielding effect ($\Delta\delta_{1-15} = 2.00$ ppm) at C-4 suggests that the second *N*-Me group is introduced at the pseudoequatorial position.

In an attempt to differentiate both diastereoisomeric series of the curine class of bis(benzylisoquinoline) alkaloids a comparison of the *O,O′*-dimethylbebeerine and *O,O*-dimethylchondrocurine *N*-metho salts (**16** and **14**) was carried out, and here again the differences in chemical shifts between both compounds are not significant.

Finally, the analysis of (+)-tubocurarine chloride (**13**), focused on the N-neighboring sp^3 carbons, was also carried out. Of the signals attributable to *N*-Me groups (C-1 and C-1′, C-3 and C-3′), those at 51.3 and 54.5 ppm together with the ones at 68.7 and 54.5 ppm were assigned to the *N*-Me groups and to C-1 and C-3, respectively, of ring B, on the basis of the known effects produced by the transformation of a tertiary base into the corresponding quaternary salt[3] (**1** → **15**, **2** → **16**, **9** → **18**). The remaining signals at 40.5, 65.1, and 45.9 ppm that were assigned to the *N*-Me, C-1′, and C-3′, respectively, of ring B′ show that the transformation of a tertiary base into its hydrochloride produces practically no changes on the neighboring carbons. These observations were supported by a comparative analysis of bebeerine (**1**) and its corresponding hydrochloride **17**, confirming that the N at ring B′ is in fact a hydrochloride as was previously shown.[8,9]

Experimental Section

The ^{13}C NMR spectra were obtained in a 10-mm spinning tube from solutions of approximately 0.5 mmol of compound in 1 mL of solvent. The instrument employed was a Varian XL-100 NMR spectrometer operating at 25.2 MHz and interfaced with a Varian 620-L Fourier transform computer with a 16K memory. The chemical shifts (±0.05 ppm) were measured at a 5-kHz spectral width, with an acquisition time of 0.8 s and a 15-μs pulse width, by using an internal deuterium lock.

Inversion recovery spectra were measured by using the usual $(\pi - \tau - \pi/2 - T)_n$ formula with $\tau = 0.3$ and $T = 20$ s. Off-resonance decoupled spectra were collected by setting the decoupler frequency a few parts per million outside the normal absorption range at a high power level. For specific H-8 decoupling the decoupler was set at the H-8 resonance frequency.

Proton magnetic resonance spectra were recorded on a Varian XL 100 spectrometer in the frequency sweep mode.

We are indebted to Dr. R. A. Seba (Instituto Vital Brazil) and Professor O. Vital Brazil, Dr. U. F. Meirelles (Departamento de Farmacologia, UNICAMP), Antonio Lapa (Escola Paulista de Medicina), and Dr. I. Ralph C. Bick (University of Tasmania) for providing generous samples of the following alkaloids: (*R,R*)-bebeerine (**1**) (=(*R,R*)-curine), (+)-tubocurarine chloride (**13**), and chondrocurine (**8**).

The following compounds were prepared by standard procedures and gave satisfactory spectral and physical data: (*R,R*)-

(8) Everett, A. J.; Lowe, L. A.; Wilkinson, S. *J. Chem. Soc., Chem. Commun.* **1970**, 1020.
(9) Codding, P. W.; James, M. N. G. *J. Chem. Soc., Chem. Commun.* **1972**, 1174.

Table III. ^{13}C NMR Data for Bebeerine *N*-Metho Salt 15 and Related Alkaloids[a]

carbons	chemical shift, ppm					
	13	14	15	16	17	18
1	68.7	68.5	65.9	66.5	61.9	69.2
3	54.5	54.7	55.0	55.3	45.0	54.3
4	23.6	23.6	23.6	24.3	21.1	23.8
4a	120.1	125.4	120.4	125.6	120.0	121.2
5	108.7	109.7	108.8	110.3	107.9	109.8
6	149.6	154.3	149.0	154.4	148.9	149.8
7	138.8	140.4	137.5	140.4	137.7	137.5
8	137.4	143.8	138.2	144.9	138.2	138.6
8a	119.8	119.9	119.9	121.2	120.0	119.2
α	38.6	39.7	36.8	37.4	40.2	37.7
9	129.0	130.8	129.1	130.2	128.0	127.4
10	124.0	123.6	123.3	124.0	120.0	129.8
11	142.4	142.5	142.0	143.0	142.1	118.2
12	148.8	149.2	147.7	149.4	147.7	154.6
13	116.7	114.5	117.1	114.1	116.5	114.9
14	127.4	127.8	123.9	124.6	126.0	129.4
1′	65.1	72.7	72.5	73.4	64.7	69.2
3′	45.9	54.2	55.0	55.5	44.4	54.3
4′	22.6	23.6	23.6	24.3	21.1	23.8
4a′	124.4	123.2	123.1	123.6	123.5	121.2
5′	112.3	112.9	113.0	113.7	112.3	109.8
6′	150.3	150.9	149.9	151.4	149.2	149.8
7′	146.4	146.0	145.2	145.4	144.2	137.5
8′	118.4	116.7	117.1	117.9	116.8	138.6
8a′	121.0	121.3	122.7	123.1	121.9	119.2
α′	40.0	37.0	38.0	38.8	39.7	37.7
9′	129.9	129.5	128.6	129.7	127.3	127.4
10′	134.0	134.1	131.6	132.3	131.9	129.8
11′	115.3	114.5	115.5	115.5	114.3	118.2
12′	156.4	156.5	155.7	156.6	155.1	154.6
13′	113.1	112.9	113.0	113.7	113.7	114.9
14′	130.8	131.2	129.9	130.9	130.1	129.4
$^{+}$NMe	40.5 (N′), 51.3 (N), 54.5 (N)	51.0, 51.2, 52.9, 54.7	51.1, 51.1, 52.4, 52.9	51.4, 51.6, 52.8, 53.5	40.4, 40.4	51.8, 51.8, 53.0, 53.0
OMe	56.4, 56.4	56.1, 56.5, 56.5, 60.7	56.4, 56.7	56.7, 56.9, 57.3, 61.4	55.9, 55.9	57.0, 57.0

[a] The spectra were obtained in (a) D_2O-MeOH for **13**, **14**, and **16**, (b) D_2O-Me_2SO for **18** and **19**, and (c) $CDCl_3$-MeOH for **15** and **17**. The chemical shifts are expressed on the Me_4Si scale according to the following equations: $\delta^{Me_4Si} = \delta^{MeOH} + 49.3$ ppm, $\delta^{Me_4Si} = \delta^{Me_2SO} + 40.4$ ppm, and $\delta^{Me_4Si} = \delta^{CDCl_3} + 76.9$ ppm for systems a-c, respectively.

O,O-dimethylbebeerine (**2**),[10] (*R,R*)-12-*O*-methylbebeerine (**4**),[10] (*R,R*)-7-*O*-acetyl-12-*O*-methylbebeerine (**6**),[10] (*R,S*)-*O,O*-dimethylchondrocurarine iodide (**14**),[11] (*R,R*)-*N,N*′-dimethylbebeerine iodide (**15**),[12] (*R,R*)-*N,N*′,*O,O*-tetramethylbebeerine iodide (**16**),[12] bebeerine hydrochloride (**17**),[12] *N,N*′-dimethylisochondrodendrine iodide (**18**).[12]

For better solution all iodide ions were exchanged by chloride by using freshly prepared silver chloride.[11]

(*R,R*)-7-*O*-Methylbebeerine (**3**) was obtained as follows. Monomethylation of **1** was carried out with CH_2N_2 by using a standard procedure,[13] yielding **3**: mp 119.2-124.0 °C; $[\alpha]^{25}_D$ -249 (*c* 0.10, $CHCl_3$); mass spectrum, *m/e* (relative intensity) 608 (M^+, 10), 204 (14), 192 (86), 190 (46), 158 (100); H^1 NMR ($CDCl_3$), see Table II; ^{13}C NMR, see Table I; $C_{37}H_{40}O_6N_2$ requires *m/e* 608.2886, found *m/e* 608.2897 (M^+).

Acetates **5** and **7** were prepared by standard methods. For (*R,R*)-12-*O*-acetyl-7-*O*-methylbebeerine (**5**): mp 95.7-99.0 °C; $[\alpha]^{25}_D$ -318 (*c* 0.12, $CHCl_3$); mass spectrum, *m/e* (relative intensity) 650 (M^+, 73), 340 (100), 312 (90); H^1 NMR ($CDCl_3$), see Table II; ^{13}C NMR, see Table I; $C_{39}H_{42}O_7N_2$ requires *m/e* 650.2992, found *m/e* 650.3020 (M^+). For (*R,R*)-*O,O*-diacetylbebeerine (**7**); mp 135.1-136.4 °C; $[\alpha]^{25}_D$ -242 (*c* 0.12, $CHCl_3$); mass spectrum, *m/e* (relative intensity) 678 (M^+, 22), 340 (100); H^1 NMR ($CDCl_3$), see Table II; ^{13}C NMR, see Table I; $C_{40}H_{42}O_8N_2$ requires *m/e* 678.2941, found *m/e* 678.2932 (M^+).

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3-Methyl-1*H*-indenones: A One-Step Conversion from 2,3-Dihydro-1*H*-indenones with *N*-Bromosuccinimide

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Preparation of strategically substituted 3-alkyl-1*H*-indenones and the precursor 2,3-dihydro-1*H*-indenones, which serve as intermediates to complex cyclic compounds of biological importance,[1-6] is usually not straightforward.