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the low-resolution infrared spectrum of monspessulanine requires one quinolizidine ring to be free from a double bond at a ring junction, and from a lactam carbonyl group.<sup>10,11</sup> The evidence favours a trisubstituted 5,6-double bond, but does not rule out the possibility of a disubstituted double bond.

Evidence for the double-bond substitution from the proton magnetic resonance spectrum is complicated by the presence, in the spectra of the saturated monolactams, dihydromonspessulanine, lupanine, 17-oxosparteine, and 13-oxylupanine, of a multiplet in the  $\tau$  5.1—5.6 region, equivalent to one proton. In this region sparteine has no absorption and 2,17-dioxosparteine shows a two-proton multiplet. The single proton likely to account for these absorptions is that at C-6(11), influenced by the  $-C(\ddot{O})\cdot N<$  system. In monspessulanine there is a single proton multiplet at  $\tau$  4.80—5.07, and no absorption at  $\tau$  5.1—5.6; this is consistent with the absence of a proton at C-6, and with the interaction of a single proton at C-5 on a trisubstituted double bond, with protons at C-4.

## EXPERIMENTAL

Infrared spectra were measured on a Perkin-Elmer Infracord 137 spectrophotometer, and identities established by infrared spectroscopy and mixed m. p. determinations.

Monspessulanine<sup>2</sup> had m. p. 101° (from acetone–water),  $[\alpha]_D +176^\circ$  (*c* 0.6—1.0 in EtOH) (Found: C, 73.1; H, 8.7. Calc. for  $C_{15}H_{22}N_2O$ : C, 73.2; H, 8.95%),  $\lambda_{max}$  (MeOH) 241.5  $\mu$  ( $\log \epsilon$  4.05) decreasing to 210  $\mu$ ,  $\nu_{max}$  (Nujol) 1645 (lactam C:O), 2820, 2780,  $\nu_{max}$  (CHCl<sub>3</sub>) 1635 (lactam C:O), 2830, 2780  $cm^{-1}$ , no peaks in the O–H or N–H stretching region. The *perchlorate*, from aqueous perchloric acid and sodium acetate, had m. p. 213° (from water),  $\nu_{max}$  (Nujol) 1620 (C:O), 1645sh (C:C), and the *picrate* had m. p. 242° (decomp.) (from ethanol) (Found: C, 53.4; H, 5.7; N, 14.5.  $C_{21}H_{25}N_5O_8$  requires C, 53.1; H, 5.3; N, 14.8%).

Dihydromonspessulanine had m. p. 103° (from light petroleum),  $[\alpha]_D +27^\circ$  (*c* 1.3 in EtOH) (Found: C, 72.5; H, 10.0. Calc. for  $C_{15}H_{24}N_2O$ : C, 72.6; H, 9.7%), ultraviolet absorption increasing from 250 to 210  $\mu$  ( $\log \epsilon$  *ca.* 3.9),  $\nu_{max}$  (Nujol, CHCl<sub>3</sub>) 1630 (lactam C:O), 2820, 2775, (in CCl<sub>4</sub>) 1635 (C:O), 2810, 2760  $cm^{-1}$ , no peaks in the O–H or N–H stretching region. The *picrate* had m. p. 182° (from methanol–water) (Found: C, 51.1; H, 6.3.  $C_{21}H_{27}N_5O_8$  requires C, 50.9; H, 5.9%), and the *perchlorate* had m. p. 220—227° (from methanol–ethyl acetate),  $\nu_{max}$  (Nujol) 1640 (lactam C:O). A methiodide could not be prepared.

*Reduction of Dihydromonspessulanine to (+)- $\alpha$ -Isparteine.*—The dihydro-base (108 mg.) in ether was stirred at 25° for 48 hr. with an excess of lithium aluminium hydride. After addition of wet ether and water the base (105 mg.) was extracted with chloroform and steam-distilled. The distillate gave a hydrochloride (17 mg.), addition of sodium hydroxide forming needles which were extracted into ether and recrystallized from water, m. p. 95—105°,  $[\alpha]_D +50^\circ$  (*c* 0.7 in MeOH),  $R_F$  0.62 [butan-1-ol–36% hydrochloric acid–water (50:7.5:17), disc method<sup>12</sup>], close to sparteine, *picrate*, m. p. 222°. These values are close to those<sup>13</sup> of (+)- $\alpha$ -isparteine, and identity was established by comparison with authentic base and *picrate*. The non-volatile base (58 mg.), chromatographed on Whatman No. 3 discs using the above solvent, gave more (+)- $\alpha$ -isparteine ( $R_F$  0.62), and two lower  $R_F$  zones.

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