On Miyaconitine and Miyaconitinone

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In an earlier paper[1], the extended formulae of miyaconitine(I) $C_{23}H_{29}O_6N$ and miyaconitinone(II) $C_{23}H_{27}O_6N$ were given respectively as follows:

(I) $C_{19}H_{20}(OAc)(OH)(=O)_3(N\text{-}Et)$

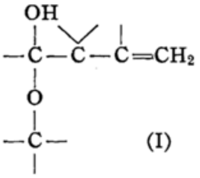
(II) $C_{19}H_{19}(OAc)(=O)_4(N\text{-}Et)$

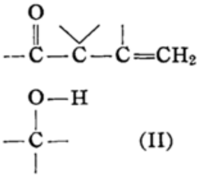
The present communication presents further consideration of the empirical and extended formulae of I and II:

(I) $C_{24}H_{31}O_6N$: $C_{20}H_{22}(OAc)(OH)(\text{-}O\text{-})\cdot(=O)_2(N\text{-}Et)$. λ_{max}^{EtOH} 295 mμ (log ε 1.6), ν_{max}^{KBr} 3470(OH), 1726, 1678(CO), 3090, 1648, 877 cm^{-1} ($\rangle C{=}CH_2$)

(II) $C_{24}H_{31}O_6N$: $C_{20}H_{22}(OAc)(OH)(=O)_3\cdot(N\text{-}Et)$. pK_a' 6.5 λ_{max}^{EtOH} 290 mμ (log ε 2.6), ν_{max}^{KBr} 3410(OH) 1728, 1715, 1676(CO), 3090, 1648, 883 cm^{-1} ($\rangle C{=}CH_2$)

The presence of the terminal methylene group was confirmed not only by the observation of infrared spectra, but also by ozonolysis and novel Lemieux oxidation[2] to give formaldehyde. Compound I showed extreme susceptibility to aldehyde reagents (viz., Fehling, Tollens and TTC, etc.), but II did not. The oxidation of I with bismuth oxide in refluxing acetic acid yielded II. The infrared spectrum of II showed a band at 3410 cm^{-1} probably due to a tertiary hydroxyl group. These observations are explained by the consideration that the conversion of I to II is not a simple oxidation of a secondary hydroxyl group to a carbonyl group but is an oxidation of a hemiketal moeity existing in I. Ultraviolet absorption of II and its alkamine, miyaconinone(III), $C_{22}H_{25}O_5N$ showed abnormal intensity due to a β, γ-unsaturated carbonyl group[3]: λ_{max}^{EtOH} 294 mμ (log ε 2.6), ν_{max}^{Nujol} 3460, 3310 (OH) 1724, 1673 (CO) 1649, 888 cm^{-1} ($\rangle C{=}CH_2$). Therefore, the partial structures of I and II may be represented by the following schemata.


(I)


(II)

Alkaline hydrolysis of II gave ψ-miyaconinone*(IV), m. p. 254~256°C, $[\alpha]_D^{20}$ −1.0°, pK_a 4.2, λ_{max}^{EtOH} 284 mμ (log ε 1.2). ν_{max}^{Nujol} 3600, 3510 (OH) 1783, 1727 (CO) 1648, 889 cm^{-1} ($\rangle C{=}CH_2$) (*Anal.* Found: C, 68.58, H, 7.48. Calcd. for $C_{22}H_{25}O_5N$: C, 68.19; H, 7.54%). This compound was obtained also by alkaline treatment of III. In the ultraviolet absorption of IV, the maximum displayed no longer the abnormal intensity as shown in those of II and III. On the other hand, the infrared spectrum of IV showed three peaks due to hydroxyl group although that of III had two peaks. Then it is considered that the reaction of II to IV involves the base-catalyzed conversion of the carbonyl group to a hydroxyl group. A plausible explanation of this reaction is that the carbonyl group showing abnormal intensity in II or III has undergone an internal aldol condensation. It has been previously reported that an α-diketone group adjacent to the nitrogen atom is present[4]. Accordingly, the condensation must have occurred in the methylene group adjacent to the α-diketone. The lower basicity of IV also supports these considerations.

In the titrations of periodate and lead tetraacetate, III and IV took up rapidly one mole more than II in one hour. It is suggested then that III and IV have a vicinal glycol system.

The composition of the fundamental base, $C_{20}H_{31}N$, and the exsistence of terminal methylene group suggest that I and II may be belonged to atisine or garryine type alkaloids.

Furthermore, it has been already reported that songorine[3b,5], one of aconite alkaloids, has the same β, γ-unsaturated ketonic system with II. And so it is considered tentatively that I and II have

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[1] H. Suginome, S. Furusawa, Y. Chiba and S. Kakimoto, *J. Fac. Sci. Hokkaido Univ. Ser. III Chem.*, **4**, 1 (1950).

[2] R. Pappo, D. S. Allen, R. V. Lemieux and W. S. Johnson, *J. Org. Chem.*, **21**, 478 (1956).

3a) R. C. Cookson and N. S. Wariyar, *J. Chem. Soc.*, **1956**, 2302.

3b) K. Wiesner, Z. Valenta, J. F. King, R. K. Maudgal, L. G. Humber and S. Itô, *Chem. & Ind.*, **1957**, 173.

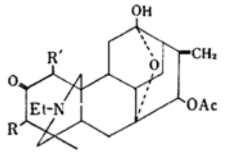
* In a previous paper[1], it has been reported that the hydrolysis of II gave miyaconine which was obtained also from I by the same hydrolysis. But the infrared spectrum of the former was different from that of the latter.

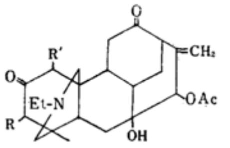
[4] S. Kakimoto, This Bulletin, **32**, 349 (1959).

[5] K. Wiesner, S. Itô and Z. Valenta, *Experientia*, **14**, 167 (1958).

closely related ring structures with these alkaloids.

Above all, it has been reported that selenium dehydrogenation of II gives phenanthrene and anthracene[6]. If anthracene ring occurred without rearrangement in the course of dehydrogenation, this fact, above consideration and the partial structures may lead possible structures for I and II as follows:





(I) R=O R'=H₂ (II)

As for the α-diketone system, $R=O$ is more probable than $R'=O$**. The infrared absorption of I or II is similar*** to that of kobusine diacetate which has an allylic acetate function[7]. It is suggested that the acetyl group in I and II covers an allylic hydroxyl group which is observed generally in alkaloids of the atisine group. Some experimental studies in order to confirm the above considerations are in progress.

The authors wish to express their deep thanks to Professor Harusada Suginome, President of Hokkaido University, for his exceedingly kind direction throughout this work.

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6) H. Suginome and S. Kakimoto, This Bulletin, 32, 352 (1959).

** In the molecular model of II, the active methylene group concerning the aldol condensation is more plausible R' than R.

*** In the comparison of infrared spectra of kobusine and kobusine diacetate, and II and III, similar shifts of the peaks were observed in the region of 870~930 cm^{-1}. These data will be reported in a later paper.

7) T. Okamoto, *Chem. Pharm. Bull. Japan*, 7, 44 (1959).