

PRELIMINARY ULTRA-VIOLET ABSORPTION STUDY OF THE HALOGEN ACID SALTS OF ALKALOIDS OF THE CONESSINE SERIES

A.J. HAMDANI, NOORUL HAQ KHAN, AND THE LATE S. MEHDI AHSAN

Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

Introduction

On the basis of studies in the von Braun¹ reaction of BrCN on tertiary bases, Siddiqui et al.^{2,3} had forwarded the view that in case of conessine and isoconessine the intensity and character of the pharmacological action of conessine was very largely dependant on the direction of the change occasioned by the alteration of the N-stability of the radicals attached to the basic nitrogen. It was further noted by Siddiqui and Sharma² that, whereas the Hoffmann degradation of isoconessine gave back the tertiary base quantitatively, the dihydriodides of conessine and iso-conessine by simple heating yielded a common hydrocarbon C₂₁H₃₀ with two additional double bonds.

In order to investigate the structural characteristics responsible for this anomaly and the influence of isomerization on the N-stability of the N-methyl groups on the one hand, and the carbocyclic nucleus on the other, a detailed study of several related alkaloids and their halogen acid salts has been undertaken, using the methods of ultraviolet absorption spectroscopy. The present communication deals with the results obtained with conimine, conessine, isoconessimine, their dihydrochlorides, dihydrobromides and dihydroiodides.

Ultra-Violet Absorption Measurements on the Bases and their Halogen Acid Salts

Solutions of strengths 0.1% and 0.01% were prepared and their absorbance was measured at a series of wave-lengths in the range 210 m μ to 400 m μ . Graphs were then drawn between log-absorbance (reduced to C=1.0%) and wave-length in m μ . In the case of the pure bases, *i.e.*, conimine and conessine, the solvent used was re-distilled ethanol, while the halogen acid salts were all soluble in distilled water. From the established structural formulae of the three bases (shown below) which contain only one double bond, no strong diene absorption due to two conjugated double bonds (at 230 \pm 5 m μ) is to be expected.

It is seen from the graph drawn for conessine that there is only one broad peak and that too of very low strength at 280 \pm 5 m μ (Fig. 1). In case of conimine, two such peaks are observed, also of small height, at 235 m μ and 280 m μ (Fig. 1). When the graphs for the dihydrochlorides of

conimine, conessine, and isoconessimine were studied, no important change in the character of the absorption was noticed, except that a low peak at about 240 m μ appears in conessine also, as can be seen from the graphs in Fig. 2. The behaviour of the dihydro-bromide of conessine is similar, with the difference that the small peak, which made its appearance in the dihydrochloride, becomes stronger and sharper (Fig. 3). Its position, 240 \pm 5 m μ , is close to the wavelength for the diene absorption.

In contrast with these rather small changes, the graphs for the dihydriodides of conessine, conimine and isoconessimine all show a remarkable feature, namely that a peak of unexpectedly large height is observed at 225 m μ as shown in Fig. 4.

By comparison with the peak molar absorbance for a diene, *i.e.*, a pair of fully conjugated double bonds, we can calculate the equivalent strength

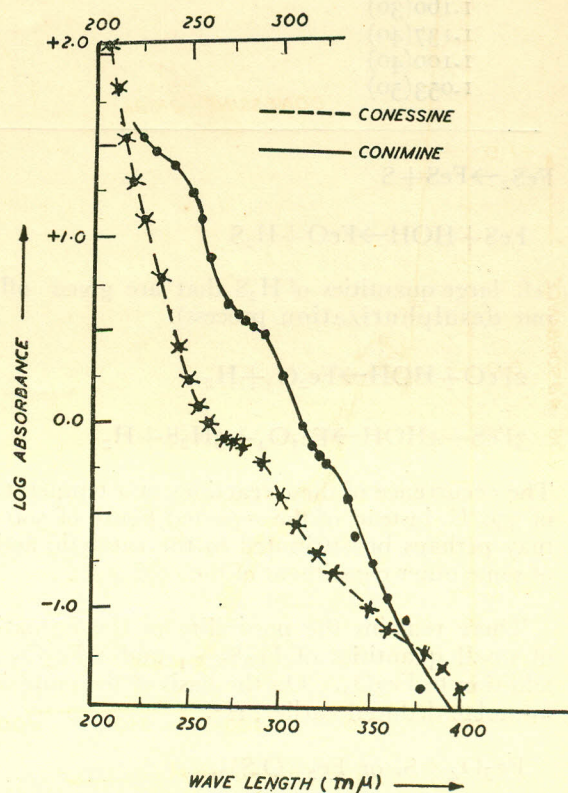


Fig. 1. Log absorbance for the bases, conessine and conimine (in ethanol) reduced to a concentration 1%.

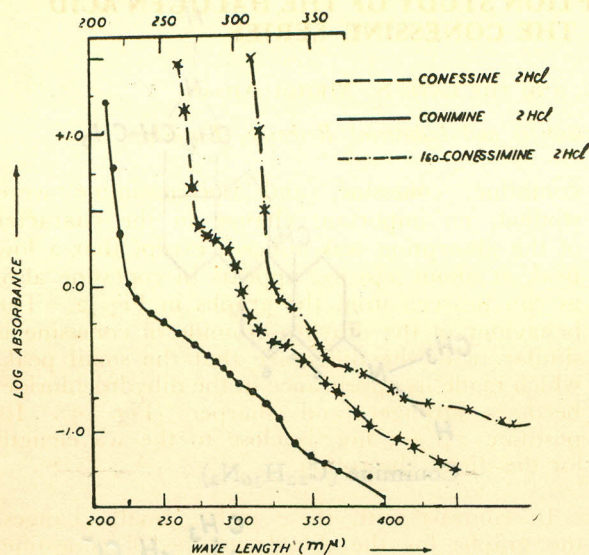


Fig. 2.—Log absorbance for the dihydrochlorides of the three bases, conessine, conimine and isoconessimine (in conductivity water) reduced to a concentration of 1% and displaced successively by 50 m μ .

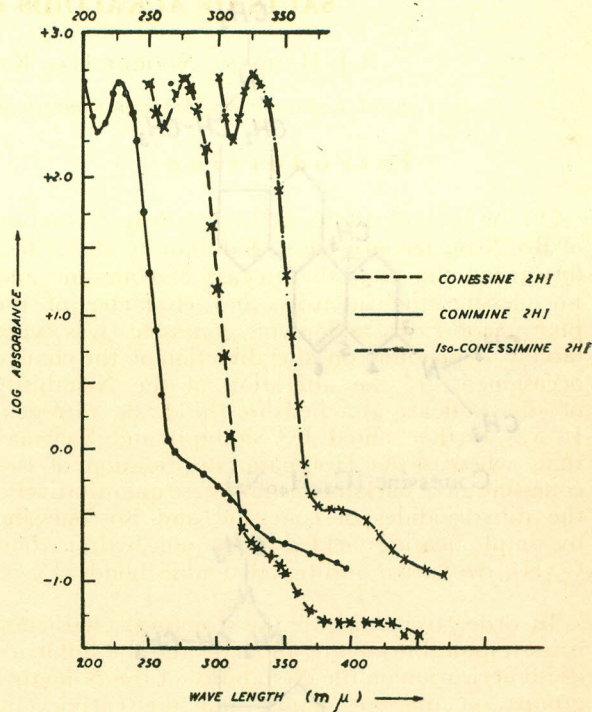


Fig. 4.—Log absorbance for the dihydroiodides of the three bases (in water) reduced to a concentration of 100%.

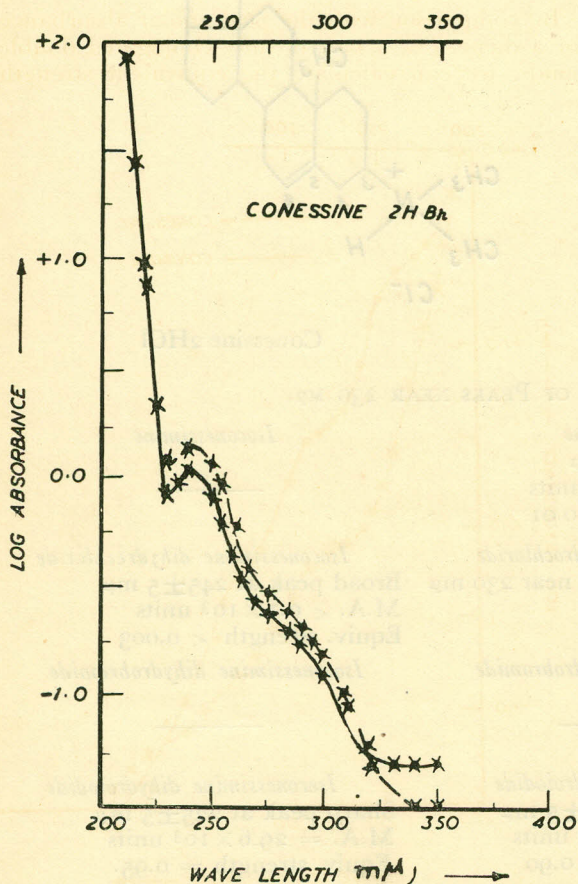
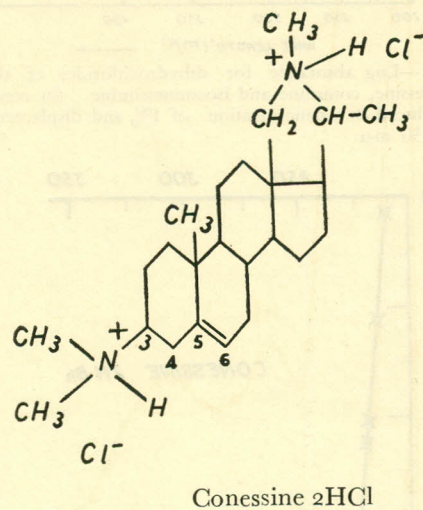
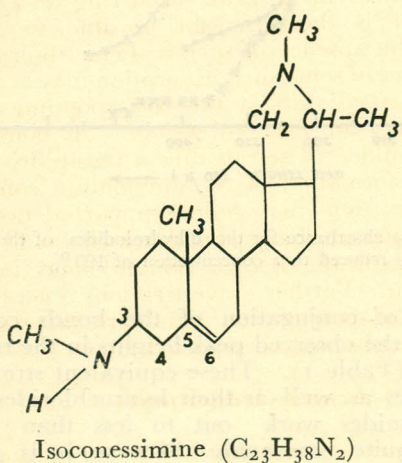
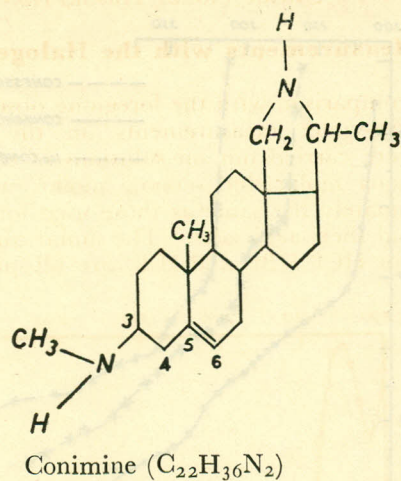
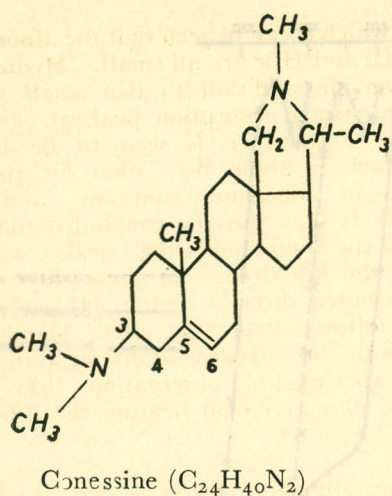


Fig. 3.—Log absorbance for the conessine dihydrobromide (two different samples) reduced to a concentration of 1%.

or degree of conjugation of the bonds corresponding to the observed peak heights in the region of 230 m μ (Table I). These equivalent strengths for the bases as well as their hydrochlorides and dihydrobromides work out to less than 0.01, which is quite reasonable, because it is usual for several of the bonds to have about 10% double bond character. However, for the dihydroiodide of these three bases *i.e.*, conimine, conessine and isoconessimine, this equivalent strength comes out to be 0.96 ± 0.05 , which would require the presence of two double bonds in a position to conjugate fully with each other. Since only one double bond (in the 5,6 position) is known to exist in the carbocyclic nucleus, and the creation of another double bond through the electronic influence of the HI group and the tertiary nitrogen atom is difficult to believe, it was thought probable that the large peak at 225 m μ is not due to the absorption by a diene. In order to clear up this point, it was considered desirable to study the ultra-violet absorption of hydroiodic acid as well as the other halogen acids.*

*The International Critical Tables do not give any data for HI while for HBr and HCl, they give only the wavelengths of the absorption maxima.

TABLE I.—ESTIMATED STRENGTH OF PEAKS NEAR 230 $m\mu$.

<i>Conessine</i>	<i>Conimine</i>	<i>Isoconessimine</i>
No detectable peak near 230 $m\mu$	Peak at 240 ± 5 $m\mu$ M.A. $\sim 0.3 \times 10^3$ units Equiv. strength ~ 0.01	—————
<i>Conessine dihydrochloride</i> Broad peak at 245 ± 5 $m\mu$ M.A. $< 0.1 \times 10^3$ units Equiv. strength < 0.003 unit	<i>Conimine dihydrochloride</i> No detectable peak near 230 $m\mu$	<i>Isoconessimine dihydrochloride</i> Broad peak at 245 ± 5 $m\mu$ M.A. $< 0.1 \times 10^3$ units Equiv. strength < 0.003
<i>Conessine dihydrobromide</i> Sharp peak at 240 ± 5 $m\mu$ M.A. $= 0.2 \times 10^3$ units Equiv. strength = 0.006.	<i>Conimine dihydrobromide</i> —————	<i>Isoconessimine dihydrobromide</i> —————
<i>Conessine dihydroiodide</i> Sharp peak at 225 ± 5 $m\mu$ M.A. = 32.4×10^3 units Equiv. strength = 1.02	<i>Conimine dihydroiodide</i> Sharp peak at 225 ± 5 $m\mu$ M.A. = 27.5×10^3 units Equiv. strength = 0.90	<i>Isoconessimine dihydroiodide</i> Sharp peak at 225 ± 5 $m\mu$ M.A. = 29.6×10^3 units Equiv. strength = 0.95.

Note: Tabulated position of diene, triene, and tetraene peaks are $230 \pm 5 m\mu$, $270 \pm 5 m\mu$, and $320 \pm 10 m\mu$, respectively.

U.V. Measurements with the Halogen Acids

For comparison with the foregoing observations, the ultra-violet measurements on the halogen acids were carried out on solutions of concentrations 0.002 molar and 0.000,2 molar, which are approximately the same as those used for the free bases and their acid salts. The molar absorbance curves for HCl, HBr, and HI, are all plotted in

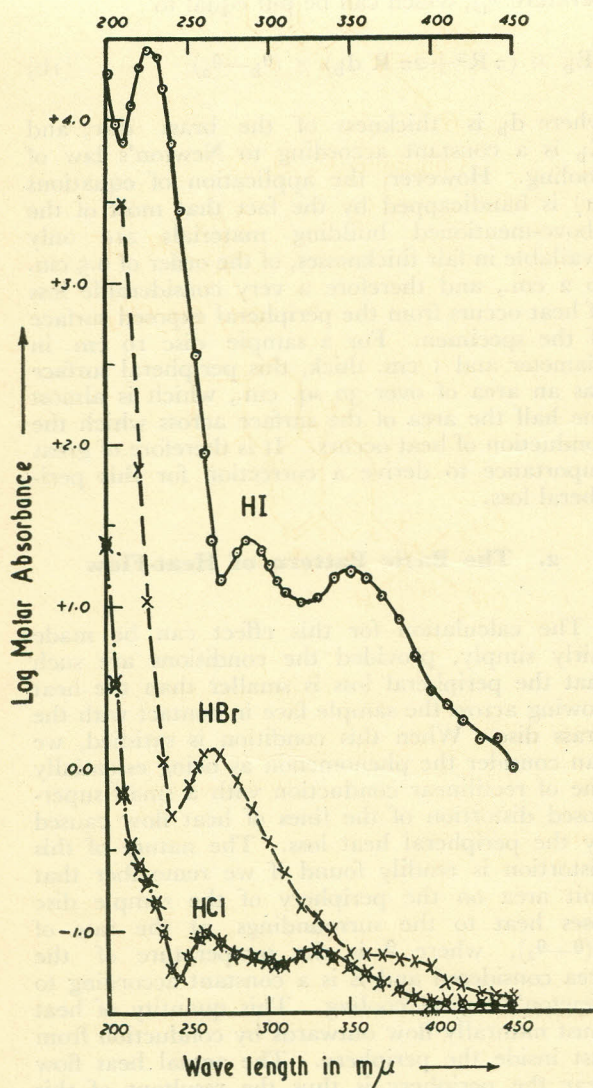


Fig. 5.—Log molar absorbance for the halogen acids, HI, HBr, and HCl (0.002 and 0.000,2 molar solutions in water).

Fig. 5, from which it can be seen that the absorption peaks for HCl and HBr are all small. Hydroiodic acid, however, in addition to two small peaks, shows a very strong absorption peak at 225 $m\mu$, whose molar absorbance is seen to be nearly 20×10^3 , which is about 60% that for the dihydroiodides of conessine, conimine, and isoconessimine. It may thus be concluded that the major part of the anomalously high peak at 225 $m\mu$ observed in the dihydroiodides of these three bases is to be attributed directly to the HI molecular group. It follows that the effect should be similar on both the nitrogen atoms, in agreement with the experimental observation that both nitrogens are eliminated on heating the dihydroiodide.

The strong absorption peak would of course mask any small diene peak, occurring at $230 \pm 5 m\mu$, and it is therefore not possible to assert definitely the absence of such a diene absorption. The existence of some such absorption may account for the observed shift of the corresponding peak from 265 $m\mu$ in HBr to 240 $m\mu$ in conessine dihydrobromide. There is thus a possibility that, due to the formation of the ammonium complex the nitrogen atom may induce a partial double-bond character on the 3,4 bond, which would then conjugate with the known double bond in the 5,6 position. Further investigations, necessary for the elucidation of this point, are in progress, and their results will be reported later.

Acknowledgements

The authors are grateful to Dr. Salimuzzaman Siddiqui for his interest in the problem, and to Dr. Mazhar M. Qurashi for help in planning and executing the ultra violet absorption measurements. Our thanks are also due to Mr. Moqaddas Ali Khan for helping with the preparation of some of the compounds.

References

1. J.v. Braun and R. Schwarz, *Ber.* **35**, 1279 (1902); J.v. Braun, *Ber.* **49**, 977, (1916); J.v. Braun, M. Kuhn and S. Siddiqui, *Ber.*, **59**, 1081 (1926).
2. S. Siddiqui, R.H. Siddiqui and V. Sharma, *Proc. Indian Acad. Sci.* **4A**, 283, (1936).
3. S. Siddiqui and V. Sharma, *Proc. Indian Acad. Sci.*, **6A**, 191-4 (1937).