Tetrahedron Letters No.27, pp. 3215-3219, 1966. Pergamon Press Ltd.
Printed in Great Britain.

THE STRUCTURE OF CULARIDINE

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(Received 22 April 1966; in revised form 4 May 1966)

Total synthesis of (+)-cularine (I) and (+)-cularimine (II) have already been described (1-7), thus confirming the structure proposed by Manske for the alkaloids (8-10). Furthermore, isolation of two phenolic bases from the alkaloids of Corydalis claviculata (L.) DC and determination of the structure of one of these, cularicine (III), have recently been achieved by Manske (11). The other base proved to be identical with cularidine (IV) which had already been obtained from Dicentra cucullaria (L.) Bernh. (10), but the position of the hydroxyl group of cularidine has not yet been elucidated.

The present MS and NMR studies of the four cularine alkaloids enables one to establish that in cularidine the hydroxyl group is at C-6.

The characteristic fragments present in the mass spectra (12) of the four alkaloids are indicated in Table 1 and Fig. 1.

All four compounds exhibit strong molecular ion peaks due to easy stabilization of the positive charge. Excepting cularicine (III), which

Table I Characteristic peaks in the mass spectra of cularine ' alkaloids.

	M^+	$M-15$	
Cularine (I)	341 (40%)	326 (100%) a	175 (5 %) b
Cularimine (II)	327 (51%)	312 (100%)	161 (19 %) c
Cularicine (III)	311 (25%)	296 (20%)	161 (8 %) d
Cularidine (IV)	327 (43%)	312 (100%)	161 (8 %) d

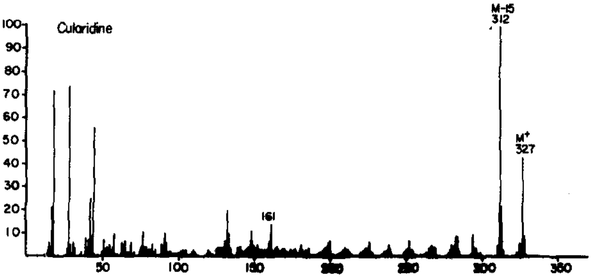
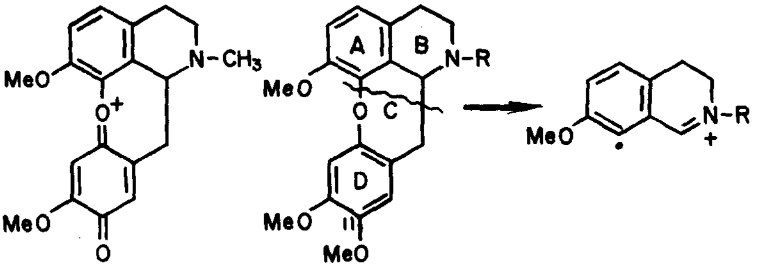


Fig. I Mass spectrum of cularidine (IV)

contains a methylenedioxy group, the base peaks occur at M-15; as already indicated by Djerassi and co-workers (13), these peaks owe their genesis to the expulsion of a methyl radical from the 11-OMe group giving rise to a quinonoid fragment such as (a) in the case of cularine (I).

A third set of characteristic peaks b - d is noted in the spectra of I-III having known structures. The O and N functions in rings A/B of these three alkaloids are methylated to various extents, i. e. , I (NMe, OMe), II (NH, OMe), III (NMe, OH). This difference in mass can be satisfactorily reflected by assigning to peaks b - d the stable cations

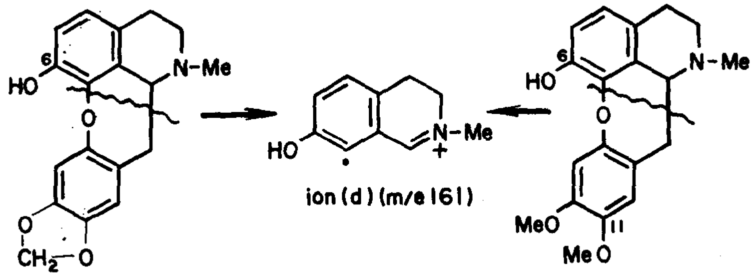


(a)

I: R=Me cularine
II: R=H cularimine

ion (b) (m/e 175): R=Me
ion (c) (m/e 161): R=H

Fig. 2



III Cularicine

IV Cularidine

Fig. 3

derived from cleavage of ring C (Fig. 2 and 3). Since the spectrum of cularidine (IV) displays a peak at m/e 161 (d), as is the case of cularimine (II) and cularicine (III), it is evident that the hydroxyl function is attached to ring A and not to ring D.

Structure IV is also fully supported by the NMR data (Table 2). Namely, the shape of the aromatic proton signals of the two 6-OMe comsimilar; the same trend is also observed to a certain extent in the signal shape around 3 ppm. Furthermore, of the three OMe peaks in cularine (I), the lowest signal at 3.89 ppm can be assigned to the 6-OMe in view of the combined effect of the adjacent diphenyl ether bond and the aromatic ring D. It is noteworthy that this low field OMe peak is absent in the cularidine spectrum. Thus, cularidine should be represented by structure IV.

Table 2. NMR peaks of the four alkaloids: $CDCl_3$, ppm from internal TMS.

	$-NCH_3$	$-OMe$	CH_2	aromatic H
cularine (I)	2.57	3.79 (3H) 3.84 (3H) 3.89 (3H)	3.22～2.64 (6 H)	6.52 (1H) 6.88～6.75(3H)
cularimine(II)		3.79 (3H) 3.85 (6H)	3.27～2.55 (6H)	6.54 (1H) 6.92～6.75(3H)
cularicine (III)	2.51	O_2CH_2 at 5.90	3.17～2.67 (6 H)	6.79 (2H) 6.67 (1H) 6.52 (1H)
cularidine (IV)	2.54	3.79 (3H) 3.83 (3H)	3.18～2.65 (6 H)	6.79 (2H) 6.72 (1H) 6.56 (1H)

ACKNOWLEDGEMENTS

We express our deep gratitude to Dr. Manske for the gift of natural products. We are also grateful to the Toyo Rayon Company for the grant to purchase the mass spectrometer.

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