Tetrahedron Letters No.36, pp. 3239-3243, 1965. Pergamon Press Ltd.
Printed in Great Britain.

10,11-DIOXOPLEIOCARPINE, A NEW ALKALOID FROM PLEIOCARPA MUTICA BENTH.[1]

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(Received 8 June 1965; in revised form 20 July 1965)

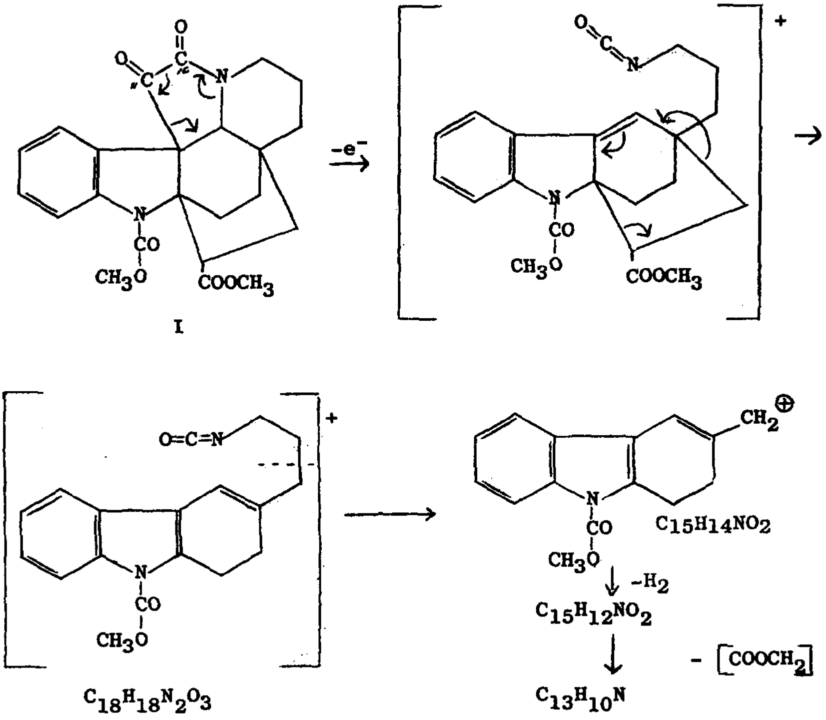
From an extract of the stem bark of Pleiocarpa mutica Benth. we have isolated a small amount (15 mg.) of a new alkaloid in the form of yellow crystals (m.p. 285-287°; $[\alpha]_D^{27}$ -265 ±5° in chloroform). Based on the evidence presented below we assign it structure I, a 10,11-dioxopleiocarpine, which thus represents still another variant of the aspidospermine-pleiocarpine type. Because of the scarcity of the material, which precluded extensive chemical transformation or degradation, the structure had to be deduced mainly from spectral evidence.

The conventional mass spectrum of the alkaloid indicated a molecular weight of 424 and was dominated by a peak at m/e 310 but otherwise did not resemble any of the known alkaloid fragmentation patterns. It thus had to be a new type or a known carbon skeleton substituted in the alicyclic part in such a way that the fragmentation pattern was greatly altered. The high resolution mass spectrum (shown in Fig. 1 in the form of an element map[2]) indicated the molecular composition to be $C_{23}H_{24}N_2O_6$ (M^+: found 424.1753, calcd. 424.1760). The lack of any other C-H-N_2O_6 ions makes the presence of alkyl substituents unlikely, while the $C_{22}H_{24}N_2O_5$ (M minus CO) and $C_{20}H_{20}N_2O_5$ (M minus CO and C_2H_4) ions suggest a cyclic carbonyl and a -CH_2-CH_2- moiety. The most abundant ion (at m/e 310) requires the loss of $C_5H_6O_3$ which could correspond to CO + CH_2=CH-CO_2CH_3. The scarcity of C-H ions and the abundance of C-H-N ions (all of low hydrogen content) point to an indole alkaloid as expected in this plant, while the absence of C-H-N_2 ions suggests the absence of a pre-existing β-carboline system. The ion of the composition $C_{15}H_{14}NO_2$ makes it likely that a substituent with two oxygen atoms is present within 15 carbon atoms containing the aromatic part.

The IR-spectrum of the alkaloid exhibits bands at 1770 cm^{-1} and 1725 cm^{-1}, suggestive of the presence of a five-ring ketone as well as one or two ester groups, and a band at 1605 cm^{-1} as well as the UV-spectrum (243 and 274 mμ; logε 4.23, 3.78), indicate an indoline system. The n.m.r. spectrum shows two singlets each of three protons at 3.57 and 3.78 ppm, requiring the presence of two methoxyl groups.

Upon reduction with lithium aluminum hydride the alkaloid gave a mixture of two products, which had molecular weights 340 (major component) and 326 (minor component). This is compatible with the reduction of CO (lactam) to CH_2, CO (ketone) to CHOH, -CO_2CH_3 to -CH_2OH and N-CO_2CH_3 to N-CH_3 (major product) or NH (minor product). The mass spectra contained peaks at M-18 confirming the presence of a new hydroxyl group and, most importantly, intense peaks at m/e 109, 110 and 124, characteristic of alkaloids of the pleiocarpine type.[3]

All these data, taken together, require structure I. The great difference between the mass spectrum of this alkaloid, in comparison with the one of pleiocarpine, must be caused by the substitution at the C-10 and C-11 which makes the "tryptamine-bridge" rather labile and favors the loss of CO. Once this has occurred the pleiocarpine-type fragmentation[3] is no longer possible. A rationalization of the mass spectrum of I is outlined below:



Structure I was confirmed by partial synthesis. Pleiocarpine was oxidized to I, using chromium trioxide in pyridine (40 hr.).[4] Chromatography of the oxidation product on silicic acid gave yellow crystals (17% yield) which were identical with I in every respect. The oxidation seems to proceed via the lactam which is the major product at shorter reaction periods (10-20 hr.) as judged from mass and IR-spectra (M 410; ν_{max} 1700 cm^{-1}).

The obvious question whether or not this compound is an artifact should be answered negatively because of the drastic condition required in the oxidation as well as the known resistance of the *Pleiocarpa* alkaloids to aerial oxidation.[5] To avoid the confusing accumulation of trivial names for new alkaloids we prefer to use the chemical name mentioned in the title of this paper.

Acknowledgement. This investigation was supported by a research grant from the National Science Foundation, (G-21037).

References

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Fig. I ELEMENT MAP OF PLEIOCARPA ALKALOID

	CH	CHN	$CHNO_2$	CHN_2O	CHN_2O_2	CHN_2O_3	CHN_2O_4	CHN_2O_5	CHN_2O_6
114	9/ 6-1••	8/ 4 0•							
115	9/ 7 0•••••	8/ 5 0•							
116	9/ 8-1•	8/ 6 1•							
117	9/ 9 0•	8/ 7 0•							
118		8/ 8 0•							
119	9/11 1•								
121	9/13 1•								
123									
124									
125	10/ 5 1•								
126	10/ 6-1•	9/ 4-2••							
127	10/ 7 0••	9/ 5 1•							
128	10/ 8-1••	9/ 6 0••							
129	10/ 9-1•	9/ 7 0•							
130		9/ 8 0•							
131	10/11 0•								
132			8/ 6 1•						
139	11/ 7 0•								
140		10/ 6 0•							
141	11/ 9-1•	10/ 7 0•							
142		10/ 8 0•							
143		10/ 9-1•							
144		10/10 0•							
149		11/ 3-2•							
151	12/ 7 0•								
152	12/ 8 0••								
153	12/ 9-2•	11/ 7 1•							
154		11/ 8 0•							
155		11/ 9 0•							
156		11/10-1•							
165	13/ 9-2••	12/ 7 0•							
166		12/ 8 0••							
167		12/ 9 0•••							
168									
178		13/ 8 0•							
179		13/ 9 0••							
180		13/10 0•••••							
181		13/11-1•••							
182		13/12 0•							
191		14/ 9 0•							
192		14/10 0•							
193		14/11-1•							
194		14/12-1•••	13/ 8 0•						
195		14/13-2•							
196		14/14-1•							
204		15/10-1•							
205		15/11-2•							
206		15/12 0•							
207		15/13-2•							
238			15/12 0•						
239									
240			15/14-1••••••						
241									
250				16/14 0•					
251				16/15-1•					
252			16/14 0•						
253			16/15 0•						
254			16/16 0•						
264			17/14 1•						
265			17/15 0•						
266			17/16-1•						
267									
277					17/13 0•				
278					17/14-2•				
279									
280									
281					17/17-2•				
308						18/16 0•			
309						18/17-1••••			
310						18/18-2••••••••			
311									
312									
335							19/15 0•		
336							19/16 1•		
337						20/21 0•			
368								20/20-1•	
393								22/21 0•	
394									
396								22/24-2•	
424									23/24 0••••