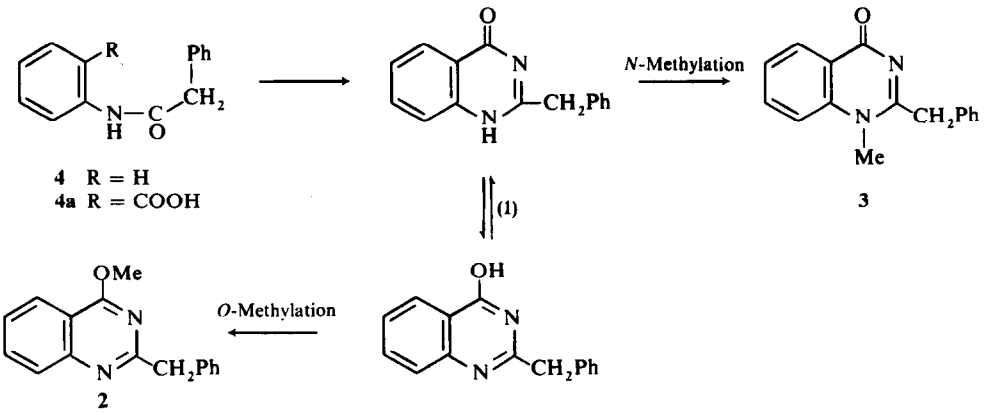

recrystallization had mp 165° and was identical to glycophymoline (mmp, TLC and IR).

Acknowledgements—Thanks are due to Dr. S. C. Bhattacharyya, Director and Prof. A. Sen, Head of the Department of Chemistry for their interest in the work.

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Phytochemistry, 1979, Vol. 18, pp. 695–696. ©Pergamon Press Ltd. Printed in England. 0031-9422/79/0401-0695 $02.00/0

MINOR ALKALOIDS OF *FUMARIA INDICA* SEEDS

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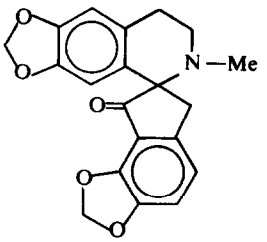
(*Received* 17 *July* 1978)

Key Word Index—*Fumaria indica*; Fumariaceae; alkaloids, fumariline: (−)-8-methoxydihydrosanguinarine; oxysanguinarine.

In continuation of our search for alkaloidal constituents of the different parts of *Fumaria indica* (Haussk) Pugsley [1–3], we now report the isolation of three alkaloids, A, B and C which were eventually proved to be fumariline (**1**), 8-methoxydihydrosanguinarine (**2**) and oxysanguinarine (**3**) respectively.



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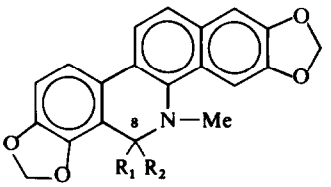

2 R_1 = OMe; R_2 = H
3 $R_1 + R_2$ = O

Alkaloid A, $C_{20}H_{17}NO_5$, mp 144°, shows UV absorption characteristic of a ketonic spirobenzylisoquinoline. The IR shows a carbonyl absorption band at 1720 cm^{-1} characteristic of a conjugated 5-membered cyclic ketone. The 60 MHz PMR in $CDCl_3$ gave signals for a N-Me (δ 2.33, *s*), two methylenedioxy (δ 5.83, 6.16, *s* each), two

vicinal (δ 6.95, *dd*, J = 8 Hz) and two isolated aromatic protons (δ 6.20, 6.56, *s* each). It also showed a diagnostic AB quartet around δ 3.4 typical of an isolated methylene adjacent to a chiral centre. The MS exhibited a M^+ at *m/e* 351 and a base peak at *m/e* 322 corresponding to the loss of CO and H from the M^+. The data are in perfect agreement with those reported for fumariline (**1**) [4] and the two alkaloids were indistinguishable after direct comparison.

Alkaloid B, $C_{21}H_{17}NO_5$, mp 195–197°, $[\alpha]_D$ −237.8° ($CHCl_3$) exhibits a UV spectrum comparable with dihydroavicine [5] and thus suggests the presence of a dihydrobenzophenanthridine chromophore. Its high resolution MS shows a M^+ at *m/e* 363.1100 corresponding to the molecular composition $C_{21}H_{17}NO_5$ and the base peak at *m/e* 332.0924 ($C_{20}H_{14}NO_4$). The genesis of the base peak by facile elimination of a OMe group strongly suggests the presence of a carbinolamine ether system of the type —N—CH—OMe. The PMR signals for an aliphatic OMe (δ 3.47, 3H, *s*) and a low field methine singlet (δ 5.4) for a proton flanked between nitrogen and oxygen functions are also consistent with such a structure. The 90 MHz PMR spectrum of the alkaloid also revealed the presence of two methylenedioxy groups (δ 6.13, 6.16, 2H, *s* each) and 6 aromatic protons spread over the region between δ 6.71 and 8, comparable to those reported for sanguinarine pseudocyanide [6]. Based on these data, alkaloid B was considered to be 8-methoxydihydrosanguinarine (**2**). Chemical evidence in support of the structure was obtained from its conversion to oxysanguinarine (**3**) effected by prolonged refluxing of an EtOH solution of B with aqueous alkali.

8-Alkoxydihydrosanguinarines are reported to be formed during crystallization with alcohols [7] and it may be questioned that alkaloid B is an artifact. However, there is no evidence to suggest that the stereospecific addition of EtOH to sanguinarine can give rise to an optically active compound like alkaloid B which is, therefore, a natural product. To our knowledge, this is the first report of the natural occurrence of (−)-8-methoxydihydrosanguinarine.

Alkaloid C, $C_{20}H_{13}NO_5$ (M^+, 347), $[\alpha]_D$ ±0°, exhibits UV and IR spectra comparable with other oxybenzophenanthridine alkaloids. Its 90 MHz PMR spectrum shows signals for one N-Me (δ 3.9, 3H, *s*), two methylenedioxy (δ 6.11, 6.28, 2H, *s* each) and 6 aromatic protons (AB quartet and singlets spread over δ 7.17–8.15). The MS shows a M^+ at *m/e* 347 and a base peak at *m/e* 318 due to the loss of CO and H from the M^+. The data suggest the identity of alkaloid C as oxysanguinarine. This was proved to be correct by direct comparison (mmp, co-TLC and IR) with an authentic sample of the alkaloid.

EXPERIMENTAL

Air-dried, powdered seeds (0.7 kg) of *F. indica* were extracted with petrol (60–80°) in a Soxhlet extractor. The petrol extract was concentrated to a dark brown oil and stirred with aq. citric acid (7%) for 12 hr. The aq. acid fraction was separated from the oily liquid, washed with petrol and extracted with $CHCl_3$ prior to and after treatment with NH_4OH to fractionate the extract into weak and strong base fractions respectively.

Fumariline (**1**). The weak base fraction was chromatographed over neutral Al_2O_3 and fractions collected were monitored by TLC at every stage for homogeneity. Fractions eluted with C_6H_6–$CHCl_3$ (4:1) furnished fumariline (21 mg), mp 144° ($CHCl_3$–MeOH), $[\alpha]_D$ +96° ($CHCl_3$: *c*, 1.0), UV: λ_{max} 234, 262, 291, 355 nm; MS *m/e* (rel. int.): 351 M^+(34), 336(10), 322(100), 308(3), 293(7), 264(7), 175(7), 135(9).

8-*Methoxydihydrosanguinarine* (**2**). The strong base fraction was chromatographed over neutral Al_2O_3. The C_6H_6 eluate yielded **2** which crystallized from MeOH as needles (24 mg), mp 195–197°, $[\alpha]_D$ −237.8° ($CHCl_3$: *c*, 0.084); UV: λ_{max} in nm (log ε): 327(4.12), 280(4.28), 235(4.23), 210(4.16); High resolution MS *m/e* (rel. int., mol. composition): 363.1100 (10, $C_{21}H_{17}NO_5$), 332.0924 (100, $C_{20}H_{14}NO_4$), 317.0684 (39, $C_{19}H_{11}NO_4$), 194.0805 (18, $C_{10}H_{12}NO_3$), 149(34), 111(23), 97(33), 83(27), 71(35), 57(55).

Conversion of 8-methoxydihydrosanguinarine (**2**) *to oxysanguinarine* (**3**). 8-Methoxydihydrosanguinarine (**2**) was refluxed with aq. EtOH N NaOH for 8 hr. The reaction mixture was diluted with H_2O, extracted with $CHCl_3$ and chromatographed over Al_2O_3 to give an alkaloid, mp 366–68°, indistinguishable from authentic oxysanguinarine in all respects (mmp, co-TLC, superimposable IR).

Oxysanguinarine (**3**). The C_6H_6–$CHCl_3$ (1:1) eluate of the strong base fraction afforded **3** (35 mg), mp 366–68°, λ_{max} 242, 280 sh, 330, 350 nm; ν_{max} 1642 cm^{-1} (amide carbonyl); MS *m/e* (rel. int.): 347(100), 346(62), 318(25), 289(14), 203(9), 159(11), 69(12), 44(34).

Acknowledgements—The authors are grateful to Prof. R. H. F. Manske who kindly compared our sample with fumariline. Sincere thanks are due to Prof. D. B. MacLean, McMaster University, Canada and to Prof. F. Santavy, Palacky University, Czechoslovakia for authentic sample of oxysanguinarine. We are indebted to Prof. R. Tschesche, Organisch Chemisches Institut, University of Bonn, W. Germany for providing instrumental facilities to one of us (V.B.P.) while he was in his laboratory as the Alexander von Humboldt Fellow. Financial assistance from C.C.R.I.M.H., New Delhi is acknowledged.

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