Phytochemistry, 1972, Vol. 11, pp. 2331 to 2332. Pergamon Press. Printed in England.

SHORT COMMUNICATION

TWO NEW SPIROISOQUINOLINE ALKALOIDS FROM *FUMARIA*

N. M. MOLLOV, H. G. KIRJAKOV and G. I. YAKIMOV

Institute of Organic Chemistry, Bulgarian Academy Sciences, Sofia 13, Bulgaria

(*Received* 23 *July* 1971, *in revised form* 15 *February* 1972)

Key Word Index—*Fumaria rostellata*; Fumariaceae; spiroisoquinoline alkaloids; fumaritrine; fumaritridine.

Abstract—The structure of two new spiroisoquinoline alkaloids, fumaritrine (V) and fumaritridine (I), isolated from plants of *Fumaria* were established on the basis of their spectral behaviour and pyrolysis to IV and VI, obtained also after pyrolysis of the alkaloid fumarophicine (III) and its *O*-methyl derivative (VII).[4]

RECENTLY many spiroisoquinoline alkaloids have been found in plants of *Fumaria* (Fumariaceae). Two new alkaloids of this group were found in some *Fumaria* species; we now report on their structures.

The first alkaloid fumaritridine(I) was isolated from *F. rostellata*[1] as colourless needles with m.p. 198–200° (ethanol) and $[\alpha]_D^{22}$ 18° (*c*, 1% $CHCl_3$). The molecular formula is $C_{21}H_{23}O_5N$ and the MW from its MS is 369. The UV of I has maxima at 215, 230 and 285 nm (ϵ, 5400, 5000 and 3000). The IR shows absorption bands for aromatic rings and hydroxyl groups. The NMR contains a three proton singlet at 2·30 δ for one N–Me group, a three proton singlet at 2·97 δ for one aliphatic methoxyl group and a similar singlet at 3·79 δ for one aromatic methoxyl group. One methylenedioxy group appears as an AB type quartet at 5·88 and 5·98 δ ($J = 0{\cdot}2$ Hz). Two vicinal methylene groups in the isoquinoline part of the molecule resonate in the field 2·50–3·30 δ. The methylene group of the spirosystem appears at 3·80 δ and the methine at 4·49 δ. Four aromatic protons absorb at 6·52 δ (one proton singlet), 6·74 δ (two proton singlet) and 6·90 δ (one proton singlet).

Although the *ortho* aromatic protons in spirobenzylisoquinoline alkaloids with structures comparable with that ascribed to fumaritridine(I) give rise to an AB quartet,[2] the corresponding signal in the spectrum of fumaritridine(I) is a singlet. However, the fortuitous equivalence of these protons is removed in the pyrolysis product (IV) in the spectrum of which the corresponding signal appears as an AB quartet.

The MS of spiroisoquinoline alkaloids with a hydroxyl group in the spiropart show that they fragment to dihydroisoquinolinium ions II.[2] The main peaks in the spectra are often due to these ions. When the hydroxyl group is acetylated as in the case of the alkaloid fumarophicine(III), the peak for the isoquinolinium ion is less intense.[3] The intense peak of III is due to the molecular ion without acetic acid. The removal of acetic acid from the molecule

[1] H G KIRJAKOV and P. P. PANOV, *C.R. Acad. Bulg. Sci.* in press.

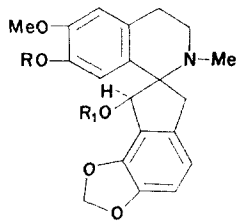
[2] D. B. MACLEAN, R. A. BELL, J. K. SAUNDERS, C.-Y. CHEN and R. H. F. MANSKE, *Can. J. Chem.* **47**, 3593 (1969); R. H. F. MANSKE, R. RODRIGO, D. B. MACLEAN, D. E. F. GRACEY and J. K. SAUNDERS, *ibid.* **47**, 3585 (1969).

[3] M. CASTILLO, J. K. SAUNDERS, D. B. MACLEAN, N. M. MOLLOV and G. I. YAKIMOV, *Can. J. Chem.* **49**, 139 (1971).

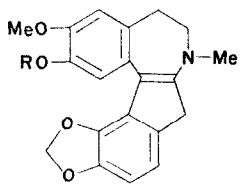
of III also occurs when the compound is heated some minutes *in vacuo* near the temperature of melting. The compound IV is a product of this pyrolysis.[4]

The MS behaviour of the new alkaloid I is close to that of III. There is a peak at *m/e* 192 for the isoquinolinium ion IIa. The low intensity of this ion is connected with the hydroxyl group which is methylated. The most intense peak is that at *m/e* 354 which corresponds to the molecular ion without a methyl group. Main peaks are those at *m/e* 338 and 337; the first is due to the molecular ion less OMe, while the second one is without methanol.

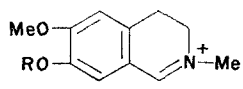
This MS behaviour of I indicates that methanol can be lost during pyrolysis, as for III. Indeed, when I was heated for some minutes *in vacuo* near the m.p., IV is obtained. The identity of the compound, proved by comparison of IR and NMR and TLC, indicates that fumaritridine has structure I. The relatively high field absorption of the aliphatic methoxyl group and down field shift of C-1 aromatic proton in the NMR suggest a similar configuration of I with those of III.[4]



(I) R = H ; R_1 = Me
(III) R = H ; R_1 = CH_3CO
(V) R = Me ; R_1 = Me
(VII) R = Me ; R_1 = CH_3CO



(IV) R = H
(VI) R = Me



(II)
(IIa) R = H

The second alkaloid fumaritrine (V) was isolated as colourless needles m.p. 153–155° (ethanol) from 'Herba Fumariae', a Bulgarian medicinal herb. The UV, IR and NMR of the compound are very similar to those of I. The difference is in the phenolic group which in V is methylated. In fact I can be methylated by diazomethane to V; comparison was made by IR and TLC. When V was pyrolysed under conditions as described above, VI was obtained. The comparison was made by means of IR and TLC with the compound obtained after pyrolysis of *O*-methylfumarophicine(VII).[4]

EXPERIMENTAL

M.ps are uncorrected and were taken on a Kofler hot-stage block. IR spectra were measured in $CHCl_3$. The chemical shifts in the NMR spectra are expressed as δ-units and are referred to TMS as internal standard. The UV spectra were made in $CHCl_3$.

Fumaritridine(I). Colourless needles with m.p. 198–200° (EtOH) (*Anal.* Calc. for $C_{21}H_{23}O_5N$: C, 68·28; H, 6·28, N, 3·79%. Found: C, 67·93; H, 6·43; N, 4·02%).

Pryolysis of I. 100 mg of I was heated 15 min at 190°. The resin was passed through alumina and eluted with light petroleum–ether (1:1). The fractions containing IV were collected and evaporated to dryness. Ethanol was added to the residue. Colourless crystals were obtained with m.p. 188–189°, completely identical with IV.

O-*methylation of* I. 50 mg of I was dissolved in MeOH and CH_2N_2 in Et_2O, obtained from 500 mg nitrosomethylurea, was added. After 24 hr the solvent was evaporated, ether and ethanol were added. Colourless needles were obtained with m.p. 153–155° identical with fumaritrine (V)

Fumaritrine (V). Colourless needles with m.p. 153–155° (EtOH). IR spectrum lacks OH absorption. NMR spectrum: 2·36 (3H, N–Me), 3·15 (3H, aliphatic O–Me), 3·90, 3·95 (6H, O–Me), 3·47 (2H, methylene), 4·68 (1H, methine), 6·06, 6·13 (2H. quadr. J = 0·2 Hz), 6·79 (1H), 6·86 (2H), 7·11 (1H), aromatic protons.

Pyrolysis of fumaritrine(V). 50 mg of V was pyrolysed as above. The reaction mixture was worked up in the same manner. VI was obtained as colourless crystalls with m.p. 209° (EtOH).

[4] N. M. MOLLOV and G. I. YAKIMOV, *C.R. Acad. Bulg. Sci.* **24**, 1325 (1971).