7.54 (*d*, $J$ = 2 Hz, 1 H, H-2′); 7.07 (*d*, $J$ = 8.5 Hz, 1 H, H-5′); 6.65 (*s*, 1 H, H-6); 5.19 (*t* (*br*), $J$ = 8 Hz, 1 H, βCH=); 3.92, 3.90 (*s*, 6 H, OMe); 3.59 (*d*, $J$ = 8 Hz, 2 H, $\alpha CH_2$), 2.47, 2.34 (*s*, 9 H, OAc); 1.74 (*s* (*br*) 6 H, γ-Me).

*Conversion of tirumalin to the corresponding flavonol by the iodine oxidation method* [4]. Tirumalin (10 mg), fused KOAc (60 mg) and HOAc (0.6 ml) were heated under reflux and to the boiling soln was added during the course of an hour a soln of $I_2$ (10 mg) in HOAc (0.4 ml). The mixture was refluxed for 3 hr, after which most of the acetic acid was removed under red. pres. and the residue treated with water satd with $SO_2$ (2 ml). The brownish yellow solid (4 mg) obtained was crystallized from MeOH to yield the dehydro derivative of tirumalin as a yellow solid. It agreed in all respects with the natural sample of rhynchospermin.

*Acknowledgement*—One of the authors (P.R.) is grateful to the UGC, New Delhi (India) for the award of a fellowship under the Faculty Improvement Programme.

REFERENCES

1. Adinarayana, D., Gunasekar, D., Ramachandraiah, P., Seligmann, O. and Wagner, H. (1980) *Phytochemistry* **19**, 478.
2. Pinhey, J. T. and Southwell, A. I. (1973) *Aust. J. Chem.* **26**, 409.
3. Mabry, T. J., Markham, K. R. and Thomas, M. B. (1970) in *Systematic Identification of Flavonoids*. Springer, New York.
4. Mahesh, V. B. and Seshadri, T. R. (1955) *Proc. Indian Acad. Sci.* **41A**, 420.

*Phytochemistry*, Vol. 20, No. 8, pp. 2059–2060, 1981.
Printed in Great Britain.

0031-9422/81/082059-02 $02.00/0
Pergamon Press Ltd.

# ALKALOIDS AND FLAVONOIDS OF *MELICOPE INDICA*

M. Th. Fauvel*, J. Gleye†, C. Moulis†, F. Blasco* and E. Stanislas†

* Institut de la Carte Internationale du Tapis Végétal, 39, Allées Jules Guesde, 31400 Toulouse, France; † Laboratoire de Matière Médicale, Faculté des Sciences Pharmaceutiques, Université de Toulouse III, 31, Allées Jules Guesde, 31400 Toulouse, France

(*Revised received* 6 *January* 1981)

**Key Word Index**—*Melicope indica*; Rutaceae; 2-quinolone; *N*-methylatanine; furoquinolines; dictamnine; evolitrine; flavones; meliternatin; melibentin; 3,5,8-trimethoxy-6,7: 3′,4′-dimethylenedioxyflavone.

**Abstract**—The following substances were isolated from the leaves of *Melicope indica*: *N*-methylatanine, dictamnine, evolitrine, meliternatin, melibentin and a new flavonoid which was shown to be 3,5,8-trimethoxy-6,7: 3′,4′-dimethylenedioxyflavone by its spectroscopic properties.

*Melicope indica* Wight is a shrubby Rutaceae which seems to be endemic of south Indian hills, at elevations of about 2200 m. This is the only one of the genus *Melicope* known in peninsular India and is apparently unused in traditional medicine. As far as we know, no phytochemical research has been carried out on *Melicope indica*. A voucher specimen (Blasco No. 1280) has been deposited at the Institut de la Carte Internationale du Tapis Végétal, 31400 Toulouse, France. Its identification has been confirmed by Dr. B. C. Stone, University of Malaya, Kuala Lumpur, who is an authority on Asiatic Rutaceae.

Three alkaloids (A, B and E) and three flavonoids (C, D and F) were extracted from the leaves by column chromatography using silica gel and alumina, and silica gel PC.

The UV spectrum of A was characteristic of a 2-quinolone [1] and was confirmed by the absence of a shift in the presence of HCl [2] and by the presence of an important peak near 1640 $cm^{-1}$ in the IR spectrum. The $^1H$ NMR spectrum indicated the presence of four aromatic protons at C-6, C-7, C-8 (between $\delta$ 7.17 and 7.42) and C-5 ($\delta$ 7.73), also indicating a 2-quinolone. The mass spectrum showed the presence of an aliphatic chain [3]. This compound was identified as a *N*-methylatanine by spectral comparison with data of a known standard. This alkaloid has already been isolated from at least two other woody plants, *Almeidea guyanensis* (Rutaceae) [4]

and *Ailanthus giraldii* (Simaroubaceae) [5].

Compound B was identified as dictamnine or 4-methoxyfuroquinoline. Its spectral data were compared with those of an authentic sample. Spectral and chromatographic properties of E were identical to those of an authentic sample of evolitrine. Compound C was identified as meliternatin or 3,5-dimethoxy-6,7:3′,4′-dimethylenedioxyflavone by its spectral data [6,7]. Compound D is related to meliternatin. Its spectral data [8] were identical to melibentin or 3,5,6,7,8-pentamethoxy,3′4′-methylenedioxyflavone.

Compound F is also related to meliternatin. The $^1$H NMR and the mass spectra, by the presence of a peak at *m/z* 209, indicates that the A-ring has one of the two methylenedioxy groups and two methoxy groups. In the mass spectrum, the peak at *m/z* 401 (M-15) is not the base peak; the presence of a C-6 methoxy group can be excluded [8]. In the $^1$H NMR spectrum in $C_6D_6$, the shifts observed for the methoxy groups of the A-ring exclude the presence of a methoxy group at C-7 [9]. Consequently, the methylenedioxy group is located at the 6,7 position. This is confirmed by the similarities observed in the shifts the $^1$H NMR spectrum, in $C_6D_6$, for the methylenedioxy of the meliternatin and of F.

The $^1$H NMR spectrum in $C_6D_6$, of F shows a peak which could be due to a C-3 methoxy group. The second methylenedioxy group is located at the 3′,4′ position. All these spectral data lead to the structure 3,5,8-trimethoxy-6,7:3′,4′-dimethylenedioxyflavone. This compound does not appear to have been isolated previously.

## EXPERIMENTAL

UV spectra were run in MeOH and IR spectra as KBr discs. $^1$H NMR spectra were run at 90 MHz in $CDCl_3$ or $C_6D_6$ using TMS as internal standard. MS were obtained at 70 eV. Mps were uncorr.

Powdered leaves (400 g) were extracted at room temp. successively with hexane and $Et_2O$. The compounds dissolved in hexane were chromatographed over Si gel using $CHCl_3$ as eluant to give three fractions. Fraction I contained A which was purified by chromatography on column of neutral alumina (hexane–$CHCl_3$, 4:1). Fraction II contained B, purified by Si gel PC ($CHCl_3$–MeOH, 99:1). Fraction III contained C which was purified by column chromatography employing Si gel ($C_6H_6$–$Me_2CO$, 4:1). The compounds dissolved in $Et_2O$ were separated on a Si gel column ($C_6H_6$–$Me_2CO$, 4:1). Three compounds, D, E and F, were obtained and then purified by chromatography on a column of Si gel ($C_6H_6$–$Me_2CO$, 19:1).

*N-Methylatanine.* Colourless crystals, mp 130°; UV $\lambda_{max}^{MeOH}$ nm: 230, 273, 282, 325, 338; MS *m/z* (rel. int.): 257 ($M^+$, $C_{16}H_{19}NO_2$, 75), 214 (M − 43, 100). $^1$H NMR ($CDCl_3$): $\delta$ 1.67, 1.79 (2 × 3 H, 2*d*, *J* = 1 Hz, –CH=$Me_2$), 3.38 (2 H, *d*, *J* = 7 Hz, –$CH_2$–CH=), 3.70 (3 H, *s*, 1-N-Me), 3.87 (3 H, *s*, 4-OMe), 5.22 (1 H, *m*, –CH=C=) 7.17, 7.35, 7.42 (3 H, *m*, 6,8,7-H), 7.73 (3 H, *m*, 5-H).

*Dictamnine.* Colourless needles, mp 135°; UV $\lambda_{max}^{MeOH}$ nm: 236,314,328; MS *m/z* (rel. int.): 199 ($M^+$, $C_{12}H_9NO_2$, 100), 184 (M − 15, 64), 156 (M − 43, 34). $^1$H NMR ($CDCl_3$): $\delta$ 4.41 (3 H, *s*, O-Me), 7.02 (*d*, *J* = 3 Hz, 3-H), 7.58 (*d*, *J* = 3 Hz, 2-H), 7.35–8.40 (4 H, *m*, 5,6,7,8-H).

*Evolitrine.* Colourless needles, mp 112°; UV $\lambda_{max}^{MeOH}$ nm: 246,308,319,332; MS *m/z* (rel. int.): 229 ($M^+$, $C_{13}H_{11}NO_3$, 100), 229 (M − 15, 64), 186 (M − 43, 40). $^1$H NMR ($CDCl_3$): $\delta$ 3.93 (3 H, *s*, 7-OMe), 4.38 (3 H, *s*, 4-OMe), 8.12 (1 H, *d*, *J* = 9 Hz, 5-H), 7.17–7.42 (4 H, *m*, 6,8,2,3-H).

*Meliternatin.* Colourless needles, mp 196°; UV $\lambda_{max}^{MeOH}$ nm: 247,272(sh), 336; MS *m/z* (rel. int.): 370 ($M^+$, $C_{19}H_{14}O_8$, 100), 339 (M − 31, 30). $^1$H NMR ($CDCl_3$): $\delta$ 3.84, 4.11 (6 H, 2*s*, 3,5-OMe), 6.04 (4 H, *s*, 6,7 and 3′,4′–O–$CH_2$O), 6.63 (1 H, *s*, 8-H), 6.88 (1 H, *d*, *J* = 9 Hz, 5′-H), 7.54 (1 H, *d*, *J* = 2, 5 Hz, 2′-H), 7.60 (1 H, *dd*, *J* = 9 and 2.5 Hz, 6′-H); $^1$H NMR ($C_6D_6$): $\delta$ 3.75, 3.95 (6 H, 2*s*, 2 × OMe), 5.02, 5.20 (2 H × 2, *s*, 6,7 and 3′,4′–O–$CH_2$–O).

*Melibentin.* Creamish needles, mp 133°; UV $\lambda_{max}^{MeOH}$ nm: 254,269(sh),341; MS *m/z* (rel. int.): 416 ($M^+$, $C_{21}H_{20}O_9$, 65), 401 (M − 15, 100), 385 (M − 31, 8), 225 (M − 191, 8). $^1$H NMR ($CDCl_3$): $\delta$ 3.85, 3.94, 3.96, 3.98 and 4.07 (15 H, *s*, 3,5,6,7,8-OMe), 6.05 (2 H, *s*, 3′,4′–O–$CH_2$–O), 6.92 (1 H, *d*, *J* = 9 Hz, 5′-H), 7.66 (1 H, *d*, *J* = 2, 5 Hz, 2′-H), 7.74 (1 H, *dd*, *J* = 9 and 2.5 Hz, 6′-H); $^1$H NMR ($C_6D_6$): $\delta$ 3.60, 3.71, 3.74, 3.78, 4.00 (15 H, *s*, 5 × OMe), 5.23 (2 H, *s*, 3′,4′-O–$CH_2$–O).

*3,5,8-Trimethoxy-6,7:3′,4′-dimethylenedioxyflavone.* Colourless prisms, mp 224°; UV $\lambda_{max}^{MeOH}$ nm: 255, 275, 338; MS *m/z* (rel. int.): 400 ($M^+$, $C_{20}H_{16}O_9$, 100), 385 (M − 15, 20), 369 (M − 31, 25), 309 (M − 191, 8). $^1$H NMR ($CDCl_3$): $\delta$ 3.89, 4.04, 4.06 (3 H × 3, 3*s*, 3,5,8-OMe), 6.07, 6.08 (4 H, 2*s*, 6,7 and 3′,4′–O–$CH_2$–O), 6.94 (1 H, *d*, *J* = 9 Hz, 5′-H), 7.68 (1 H, *d*, *J* = 2.5 Hz, 2′-H), 7.76 (1 H, *dd*, *J* = 9 and 2.5 Hz, 6′-H). $^1$H NMR ($C_6D_6$): $\delta$ 3.63, 3.78, 3.98 (9 H, 3*s*, 3 × OMe), 5.01, 5.20 (2 H × 2, 2*s*, 6,7- and 3′,4′-O–$CH_2$–O).

## REFERENCES


1. Clarke, E. A. and Grundon, M. F. (1964) *J. Chem. Soc.* 4190.
2. Ritchie, E., Taylor, W. C. and Vautin, S. T. K. (1965) *Aust. J. Chem.* **18**, 2021.
3. Lavie, D., Danieli, N., Weitman, R. and Glotter, E. (1968) *Tetrahedron* **24**, 3011.
4. Moulis, Cl., Wirasutisna, K., Gleye, J., Stanislas, E. and Moretti, C. (1979) *Alcaloïdes de* Almeidea guyanensis *Pulle* (*Rutacées*), Colloque International CNRS, Orstom.
5. Bohlmann, F. and Bhaskar Rao, V. S. (1969) *Chem. Ber.* **102**, 1774.
6. Fukui, K. and Matsumoto, T. (1963) *Bull. Chem. Soc. Jpn.* **36**, 806.
7. Briggs, L. H. and Locker, R. H. (1949) *J. Chem. Soc.* 2157.
8. Le-Van, N. and Cuong Pham, T. Van (1979) *Phytochemistry* **18**, 1859.
9. Wilson, R. G., Bowie, J. H. and Williams, D. H. (1968) *Tetrahedron* **24**, 1407.