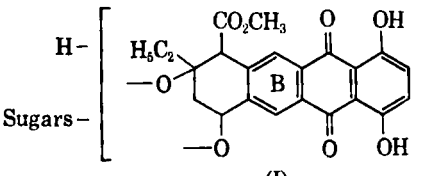
acid in glacial acetic acid after acetylation with acetic anhydride/pyridine), and then in very poor yield. Under these strenuous conditions, the anthracycline terminal ring undergoes dehydration to the fully aromatic system. Our amorphous product has so far resisted purification but possesses a visible absorption maximum at 478 mμ in methanol solution. Brockmann has shown that in many cases conversion of anthraquinones to the corresponding tetracenequinones results primarily in an increase in ultraviolet absorption intensity and has relatively little influence upon the position of the visible maxima (7). Aklavinone (II) would appear to be exceptional, for in this case a pronounced wavelength shift was obtained (8). Because this introduces an element of uncertainty in the spectral conclusions, 1,4-dihydroxynaphthacene-5,12-quinone, m.p. 285°, was prepared by the Friedel-Crafts condensation of 1,4-dimethoxybenzene and naphthalene-2,3-dicarboxylic acid anhydride.

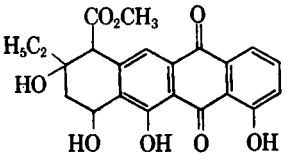
*Anal.*—Calcd. for $C_{18}H_{10}O_4$: C, 74.48; H, 3.47; O, 22.05. Found: C, 74.17; H, 3.68; O, 21.48.

Due to poor methanol solubility, carbon tetrachloride was used as solvent for spectral examination, and a visible maximum was observed at 466 mμ. This is in reasonable agreement with that of 1,4-dihydroxyanthraquinone (max. at 470 mμ). Thus, there seems to be little doubt that the chromophore of the ruticulomycins is as depicted in formula I. These observations serve to emphasize the uniqueness of the ruticulomycins among the anthracyclines, since all of the previously described members have at least one hydroxyl substituent in ring B (1).

Using the anthracycline parent nucleus (1) and placing the ester function by analogy to those compounds of this series whose structures are already known, it seems reasonable to propose structure I as a working hypothesis for further studies and to infer that A and B differ from one another in the sugar portion of the molecule.




(I)




(II)

(1) For a review of these compounds, see Brockmann, H., "Progress in the Chemistry of Organic Natural Products," Vol. 21, Springer-Verlag, Vienna, Austria, 1963, p. 121.
(2) Miller, M. W., and Hochstein, F. A., *J. Org. Chem.*, **27**, 2525(1962).
(3) Bloom, H., Briggs, L. H., and Cleverley, B., *J. Chem. Soc.*, **1959**, 178.
(4) Spruit, C. J. P., *Rec. Trav. Chim.*, **68**, 325(1949).
(5) Brockmann, H., Boldt, P., and Niemeyer, J., *Chem. Ber.*, **96**, 1356(1963).
(6) Brockmann, H., and Boldt, P., *ibid.*, **94**, 2174(1961).
(7) Brockmann, H., and Muller, W., *ibid.*, **92**, 1164(1959).
(8) Gordon, J. J., *et al.*, *Tetrahedron Letters*, (No. 8) 28 (1960).

Lester A. Mitscher
William McCrae
William W. Andres
James A. Lowery
Nestor Bohonos

Biochemical Research Section
Lederle Laboratories Division
American Cyanamid Company
Pearl River, N. Y.

Received June 11, 1964.
Accepted for publication June 29, 1964.

The authors thank Drs. L. M. Pruess, J. S. Schultz, and co-workers for carrying out the fermentations, Dr. H. D. Tresner for culture identification; and Messrs. A. C. Dornbush, J. H. Martin, M. Dann, L. F. Brancone, W. Fulmor, and their associates for microbiological assays, paper chromatography, preparation of large-scale concentrates, microanalyses, and spectra, respectively.

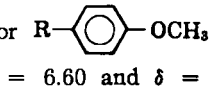
# Characterization of a New Magnoliaceae Alkaloid

*Sir:*

In a previous communication (1) the authors reported results of preliminary studies on the alkaloids of *Magnolia acuminata* L. Fractionation of the stem extracts revealed the major alkaloids to be of the quaternary type. Five such bases were detected by paper chromatographic technique. Of these, three phenolic alkaloids—*viz.*, salicifoline, magnoflorine, and magnocurarine—were identified. Choline was revealed to be the fourth base. Identification of salicifoline and magnocurarine was confirmed by isolation of the picrates of the alkaloids and comparison with authentic samples.

Chromatography of the purified quaternary alkaloid fraction indicated magnoflorine to be the major phenolic base. While purifying other frac-

tions of the leaves, however, Kapadia isolated a nonphenolic tertiary alkaloid and a neutral ketone. The latter compound was isolated from petroleum ether extract of dry leaves and characterized as palmitone by elemental analysis and comparison of I.R., NMR, mass spectra, and mixed melting point of the isolated and synthetically prepared ketone.

The alkaloid was isolated from an ethanolic extract of the leaves which were previously deprived of petroleum ether and methylene chloride extractives. The residue from alcoholic extract was purified, and the alkaloidal oxalate was obtained as a colorless product from chloroform. Attempts to obtain a crystalline free base were not successful, but paper, thin-layer, and gas-liquid chromatographic examination of the product, $[\alpha]_{589}^{23} = 68.7°$ and $[\alpha]_{436}^{23} = 177.6°$ (C = 1.165, $CHCl_3$), indicated a single alkaloid to be an almost exclusive constituent. NMR spectrum (in $CDCl_3$) indicated presence of three aromatic methoxyl groups (9H at $\delta$ = 3.87, 3.80, 3.60 p.p.m.) and one *N*-methyl (3H at $\delta$ = 2.55 p.p.m.). Other peaks could most likely be assigned as four aromatic protons in an $A_2B_2$ system ($\delta$ = 7.07, 6.83 p.p.m.) suitable for  and one proton each at $\delta$ = 6.60 and $\delta$ = 6.10 p.p.m., each of which was also probably aromatic. Results suggested that the alkaloid was *d*-*O*-methylarmepavine. Identity of the base was confirmed with this compound by comparison with an authentic sample of *l*-*O*-methylarmepavine. Paper, thin-layer, gas-liquid chromatographic data, and U.V. and I.R. spectra of the isolated base and authentic *l*-*O*-methylarmepavine were identical. The NMR spectrum of the isolated alkaloid was also identical with that of *dl*-*O*-methylarmepavine, synthesized by a method[1] differing from that reported by Marion *et al.* (2) and Tomita and Yamaguchi (3). Preparation of crystalline hydrochloride [m.p. 198–199° (chloroform-petroleum ether)].

*Anal.*—Calcd. for $C_{20}H_{26}O_3NCl$: N, 3.85%. Found: N, 3.84%.

The methiodide [m.p. 135–137° (sinters at 128°); reported m.p. 135° (sinters at 127°) (4) and 137–138° (5); $[\alpha]_{589}^{24} = 91.7°$ and $[\alpha]_{436}^{24} = 249°$ (C = 0.193, MeOH)] of the isolated alkaloid and I.R. spectra identical to that of the corresponding alkaloidal hydrochloride and methiodide prepared from authentic base further confirmed the isolated compound as *d*-*O*-methylarmepavine.

Although *dl*-*O*-methylarmepavine has been synthesized (2, 3) and *d*, *l*, or *dl*- forms of the alkaloid have been obtained either as derivatives of armepavine and coclaurine (6–9) or in degradation studies of bisbenzylisoquinolines (5, 10–15), *M. acuminata* appears to be the first plant from which the alkaloid has been isolated and characterized.

Details of the methods for isolation and characterization reported here will be published at a later date.

[1] A modified synthesis of *dl*-*O*-methylarmepavine is being reported separately.

(1) Kapadia, G. J., Baldwin, H. H., and Shah, N. J., *J. Pharm. Pharmacol.*, **16**, 283(1964).
(2) Marion, L., Lemay, L., and Portelance, V., *J. Org. Chem.*, **15**, 216(1950).
(3) Tomita, M., and Yamaguchi, H., *Pharm. Bull. Japan*, **1**, 10(1953).
(4) Bick, I. R. C., and Clezy, P. B., *J. Chem. Soc.*, **1953**, 3893.
(5) Fujita, E., and Tomimatsu, T., *J. Pharm. Soc. Japan*, **79**, 1260(1959).
(6) Tomita, M., Watanabe, V., and Furukawa, H., *ibid.*, **81**, 1644(1961).
(7) Kupchan, S. M., *et al.*, *Tetrahedron*, **19**, 227(1963).
(8) Tomita, M., and Kusuda, F., *J. Pharm. Soc. Japan*, **72**, 280, 793(1952).
(9) Yamaguchi, H., *ibid.*, **78**, 692(1958).
(10) Tomita, M., Fujita, E., and Murai, F., *ibid.*, **71**, 226(1961); also see references cited in *Reference 3*.
(11) Tomita, M., Fujita, E., *Pharm. Bull. Japan*, **1**, 101(1953).
(12) *Ibid.*, **2**, 378(1954).
(13) Tomita, M., Ito, K., and Yamaguchi, H., *ibid.*, **3**, 449(1955).
(14) Tomita, M., and Yashiro, S., *J. Pharm. Soc. Japan*, **78**, 543(1958).
(15) Kikuchi, T., and Bessho, K., *ibid.*, **78**, 1413(1958).

GOVIND J. KAPADIA*
NARENDRA J. SHAH*
R. J. HIGHET†

*Department of Pharmacognosy and Natural Products
College of Pharmacy
Howard University
Washington, D. C.

†National Heart Institute
National Institutes of Health
U. S. Public Health Service
Bethesda, Md.

Received June 11, 1964.
Accepted for publication July 6, 1964.

This investigation was supported by Grant H-06571 from the National Institutes of Health, U. S. Public Health Service, Bethesda, Md.

The authors are indebted to Professor Masao Tomita, Kyoto University, Kyoto, Japan, for the sample of *l*-*O*-methylarmepavine; to Professor A. L. Burlingame, University of California, for the mass spectrum; and to Mrs. K. S. Warren for other spectrometric determinations.