74. Tatsuhiko Nakano: Studies on the Alkaloids of Magnoliaceous Plants. XIII[1]. Alkaloids of *Magnolia grandiflora* L. (2)*.

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In the preceding paper[1] of this series, the author described an investigation on the alkaloids of the root of *Magnolia grandiflora* L. and showed that it contained salicifoline and candicine.

Investigations on *Magnolia grandiflora* L. were continued with further supplies of the plant material which was collected late in February, 1953, on the outskirts of the campus of the University of Kyoto, and their scope was extended to include a study of the alkaloidal constituents in the bark of the same plant. In this paper the isolation of a new quaternary alkaloid of unknown constitution is presented.

The methanolic extract from 24.2 kg. of the fresh bark was treated by the procedures described in the experimental section, and yielded only a trace of tertiary bases, too small to allow further examinations. On the other hand, quaternary bases, after having been purified as the reineckates, were converted into the chlorides, but they did not readily crystallize. When they were treated with an aqueous sodium picrate solution, however, they gave a precipitate, which on recrystallization from acetone, crystallized in the form of orange yellow prisms, m.p. 181~182°, weighing 1.7 g. From the analytical values, its empirical formula represented the composition of $C_{12}H_{20}O_2N \cdot C_6H_2O_7N_3$, the identity of which was established by admixture with an authentic sample of salicifoline picrate, m.p. 181~182°.

The uncrystallized syrupy mother liquor left after the isolation of salicifoline picrate was dissolved in a small amount of acetone and after acidification with 1% aqueous hydrochloric acid solution, extracted exhaustively with successive portions of ether to remove the picric acid. The aqueous layer was evaporated *in vacuo* at 45° to dryness, after which the residue was dissolved in the minimum amount of water and treated with an aqueous sodium styphnate solution. The resulting precipitate was recrystallized from acetone and furnished 3 g. of yellow prisms, m.p. 218.5~219°(decomp.). From the mother liquor from the above styphnate, there was obtained an additional amount of 2.5 g. of the initial styphnate, m.p. 218.5~219°(decomp.). This second alkaloid gave analytical values corresponding to $C_{29}H_{24}O_4N \cdot C_6H_2O_8N_3$. Although it has not yet been obtained as a crystalline chloride, etc., this alkaloid is a new one never before reported in the literature, for which the name magnoflorine is proposed. This quaternary base may be regarded as the main alkaloidal constituent of the bark of *Magnolia grandiflora* L. The chemical constitution of magnoflorine is now being studied, the details of which will be published in the near future.

For convenience of comparison the main quaternary alkaloids so far identified by Tomita and his co-workers from several species of the Magnolia genus, family Magnoliaceae, are listed in Table I.

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* Masao Tomita: Studies on the Alkaloids of Magnoliaceous Plants. XIII.

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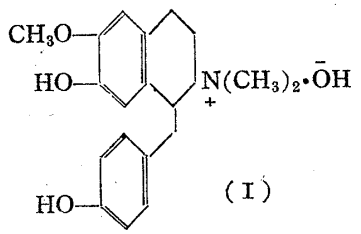
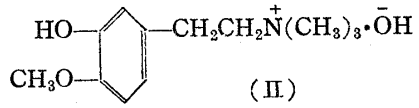
1) Part XII. T. Nakano: This Bulletin, 2, 321 (1954).

TABLE I.

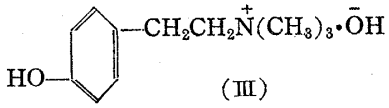
Species	Main Quaternary Alkaloids				
	Magnocurarine (I)	Salicifoline (II)	Picrate (m.p. 222~223°)	Candicine (III)	Magnoflorine
M. obovata Thunb.[2]	+	−	−	−	−
M. salicifolia Maxim.[3]	+	+	−	−	−
M. kobus DC.[4]	−	+	−	−	−
M. stellata Maxim.[5]	−	+	−	−	−
M. denudata Desr.[6]	+	+	+	−	−
M. liliflora Desr.[7]	+	+	−	−	−
M. grandiflora L.[1]	−	+	−	+	+



(I)



(II)



(III)

Experimental[8]

Isolation of the Alkaloids from the Bark of *Magnolia grandiflora* L.

(1) **Salicifoline**—The plant material used was collected late in February, 1953, on the outskirts of the campus of the University of Kyoto. The coarsely ground bark (24.2 kg. based on undried material) was extracted with warm MeOH and the solvent removed under a reduced pressure. The sticky residual mass was treated in the conventional manner, and yielded only a small amount of the tertiary bases, too small to be worked up. On the other hand, the quaternary bases, after being purified as the reineckates, were decomposed by Ag_2SO_4 and then converted into the chlorides, but they did not readily crystallize. When they were treated with a conc. aq. sodium picrate solution, however, they produced a precipitate which was dissolved in acetone, and on concentration of the solution to a small bulk, furnished a small amount of crystals, but the major part of the mother liquor remained a syrupy oil. Further recrystallization of the deposited crystals from acetone yielded 1.7 g. of orange yellow prisms, m.p. 181~182°, undepressed on admixture with an authentic sample of salicifoline picrate, m.p. 181~182°. *Anal.* Calcd. for $C_{12}H_{20}O_2N \cdot C_3H_2O_7N_3$: C, 49.31; H, 5.06. Found: C, 49.51; H, 5.22.

On treatment with KI salicifoline chloride was converted into its corresponding iodide which crystallized from H_2O–MeOH–acetone in colorless slender pillars, m.p. 217~218°. A sample was dried *in vacuo* at 95° over P_2O_5 and melted at 212~214°. *Anal.* Calcd. for $C_{12}H_{20}O_2NI$: C, 42.74; H, 5.98. Found : C, 43.15, 43.11; H, 6.07, 6.02. An aq. solution of the iodide gave a yellowish brown color with $FeCl_3$, gradually changing to dark green, whereas that of the chloride gave a green color under the same condition.

(2) **Magnoflorine**—The uncrystallized syrupy mother liquor left after the isolation of salicifoline picrate was dissolved in a small amount of acetone and acidified with 1% aq. HCl solution. The aq. phase was shaken repeatedly with successive portions of ether until all of the picric acid was removed. The aq. solution was evaporated *in vacuo* at 45°, the residue was dissolved in the minimum amount of water, and treated with a conc. aq. sodium styphnate[9] solution. The resulting precipitate was dissolved in acetone, and on concentration of the solution to small bulk, yellow prisms were obtained. Recrystallization was effected from acetone; m.p. 219~221°(decomp.), yield, 3 g. The analytical sample

2) M. Tomita, Y. Inubushi, M. Yamagata : J. Pharm. Soc. Japan, **71**, 1069 (1951).
3) M. Tomita, T. Nakano : *Ibid.*, **72**, 197 (1952); *ibid.*, **72**, 281 (1952); *ibid.*, **72**, 1256 (1952).
4) *Ibid.*, **72**, 727 (1952).
5) *Ibid.*, **72**, 766 (1952).
6) *Ibid.*, **72**, 1260 (1952).
7) T. Nakano : This Bulletin, **1**, 29 (1953).
8) All melting points are uncorrected. The author is indebted to Mr. K. Hozumi and his associates in the Microanalytical Laboratory of this Institute for the microanalyses.
9) An aq. solution containing a 1:1 mixture of styphnic acid and NaOH caused a far more complete precipitation than an ethanolic solution of styphnic acid itself.

was dried *in vacuo* at 80° over P_2O_5 and had m.p. 218.5~219°(decomp.). It is soluble in a mixture of water and acetone, less soluble in acetone, and very sparingly soluble in EtOH. *Anal.* Calcd. for $C_{20}H_{24}O_4N \cdot C_6H_2O_8N_2$: C, 53.24; H, 4.47; N, 9.55. Found: C, 53.08; 53.47; H, 5.02, 4.82; N, 9.59; 9.70.

From the mother liquor from the above styphnate, there was obtained an additional amount of 2.5 g. of the initial styphnate, m.p. 218.5~219°(decomp.); over-all yield, 5.5 g.

Paper Chromatography of Magnoflorine and other Alkaloids—Toyo Roshi No. 50 paper was used, and development was effected by the ascending technique in a sealed tank, with, as routine solvent systems, the upper layer of the mixtute of BuOH(50 cc.), AcOH(10 cc.), and H_2O(40 cc.), which gave the best results of a range examined. For the detection of alkaloidal spots, the Dragendorff[10] reagent and the potassium salt of tetrabromophenolphthalein ethyl ester[11] were used. The Rf values in the above concentration of BuOH–AcOH–H_2O for magnoflorine and other alkaloids (ca. 15 γ used in each case) under the same conditions are given below:

	Rf values
Salicifoline chloride (II)	0.53~0.54
Magnocurarine (I)	0.68~0.69
Magnocurarine chloride	0.64~0.66
Candicine iodide (III)	0.56~0.58
Magnoflorine styphnate	0.53~0.55*

* shows fluorescence under the ultraviolet rays

Summary

From the bark of *Magnolia grandiflora* L. (Magnoliaceae), growing in Japan, two kinds of quaternary bases were isolated. One was identified as salicifoline, and the other was induced to crystallize as the styphnate. The second alkaloid is a new one never heretofore reported in the literature, for which the name magnoflorine was proposed. This base may be regarded as the main alkaloidal constituent in the bark of this plant, the chemical structure of which is now being studied.

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10) The reagent with a prescription reported by R. Munier and M. Macheboeuf (Bull. soc. chim. biol., **31**, 1144(1949)) gave a far more satisfactory result in the detection of alkaloidal spots; the position of alkaloids was shown by a distinct red spot on a white background.

11) I. R. C. Bick, E. S. Ewen, A. R. Todd: J. Chem. Soc., **1949**, 2774; F. Feigl: "Qualitative Analyse mit Hilfe von Tüpfelreaktionen", III. Aufl., 445(1938).