365. *An Examination of the Rutaceae of Hong Kong. Part II.*[1] *The Alkaloids, Nitidine and Oxynitidine, from* Zanthoxylum nitidum.

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Nitidine and oxynitidine, two new benzophenanthridine alkaloids, have been isolated from *Zanthoxylum nitidum*. Unlike the other alkaloids of this class, these compounds are substituted in the 6 : 7 : 2′ : 3′-positions.

Zanthoxylum nitidum (Lam.) DC. (*Fagara nitida*), known locally as *Ju ti chin niu* (golden cow in the soil), a woody climber with yellow root and small white flowers, grows in most areas of Hong Kong Colony. An investigation of the bacteriostatic properties of the Formosan plant has been reported,[2] and in Part I [1] we showed that diosmin occurred in the root bark.

An alkaloid, oxynitidine, and a salt of a related quaternary alkaloid, nitidine, have now been isolated from the methanol extracts of the root bark and root wood. Oxynitidine is insoluble in water and thus was separated from the quaternary salt when the mixture as isolated was boiled with water. Basification of the aqueous salt solution produced two compounds dihydronitidine, $C_{21}H_{19}O_4N$, and oxynitidine, $C_{21}H_{17}O_5N$ by disproportionation. Since dihydronitidine was easily oxidised by air it was separated from oxynitidine by chromatography under argon.

Each of these compounds contained two methoxyl groups and one methylenedioxy-group (positive Labat test); on mild oxidation dihydronitidine gave oxynitidine, the reverse process being effected by reduction. Dihydronitidine formed salts; oxynitidine did not, and hence it was considered that the fifth oxygen atom of oxynitidine was present in a substituted amide function. Thus dihydronitidine was isomeric with, and contained the same functional groups as, dihydrochelerythrine (I). Oxynitidine appeared to be similarly related to oxychelerythrine (II).

Although distillations with zinc and fusions with zinc and zinc chloride gave no evidence that these two compounds were benzophenanthridine derivatives, the general chemical properties of both suggested that they were; further, the ultraviolet spectrum of dihydronitidine resembled closely that of dihydrochelerythrine.

Dihydronitidine and oxynitidine were shown not to be related to dihydrochelerythrine and oxychelerythrine simply by interchange of the substituent methoxyl groups with that of the methylenedioxy-group since the tetramethoxy-compound (A), obtained from oxynitidine, was not identical with the tetramethoxybenzophenanthridone (III), obtained by oxidation of 9 : 10-dihydro-7 : 8 : 2′ : 3′-tetramethoxy-10-methyl-1 : 2-benzophenanthridine [3] (IV), the reference compound for the chelerythrine–sanguinarine group of alkaloids synthesised [4] in 1950.

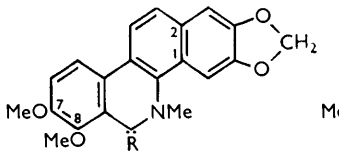
However, degradative oxidation of oxynitidine, which was difficult to control, gave *N*-methyl-*m*-hemipinimide. This suggested that the methoxyl groups of our bases were substituted in the 6 : 7-positions of the benzophenanthridine skeleton, instead of in the 7 : 8-positions as in the chelidonine group of alkaloids. This view, which was supportable on biogenetic grounds, was confirmed thus: the methosulphate of 6 : 7 : 2′ : 3′-tetramethoxybenzophenanthridine [4] was reduced to give 9 : 10-dihydro-6 : 7 : 2′ : 3′-tetramethoxy-10-methyl-1 : 2-benzophenanthridine (V) which was shown to be identical with the reduction product (B) of the tetramethoxy-compound (A) obtained from oxynitidine. Thus compound A must be represented by formula (VI), and oxynitidine is therefore 6 : 7-dimethoxy-10-methyl-2′ : 3′-methylenedioxy-1 : 2-benzophenanthridone (VII). The structure of the other alkaloid, nitidine (6 : 7-dimethoxy-10-methyl-2′ : 3′-methylenedioxy-1 : 2-benzophenanthridinium hydroxide) (VIII), and that of the transformation product,

[1] (*a*) Part I, *J.*, 1956, 632; (*b*) cf. also Arthur, Hui, and Ng, *Chem. and Ind.*, 1958, 1514.
[2] Yang, Chang, and Weng, *J. Formosan Med. Assoc.*, 1953, **52**, 109.
[3] Späth and Kuffner, *Ber.*, 1931, **64**, 2034.
[4] Bailey, Robinson, and Staunton, *J.*, 1950, 2277.

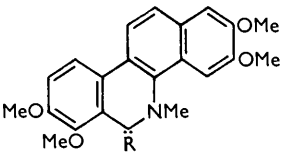
dihydronitidine (9 : 10-dihydro-6 : 7-dimethoxy-10-methyl-2′ : 3′-methylenedioxy-1 : 2-benzophenanthridine) (IX), follow.

The yellow water-soluble quaternary salt of nitidine obtained from the plant could not be purified nor could nitidine itself be obtained from it, since basification of the salt solution, or subjecting a solution of it to ion-exchange or chromatography, caused disproportionation. Nitidine, however, has been characterised as the ψ-cyanide since this compound is readily prepared from an aqueous solution of the naturally occurring salt. Nitidine has also been characterised as the acetate, chloride, iodide, and periodide.

Owing to the ease of aerial oxidation of solutions of dihydronitidine salts to the corresponding nitidine salts, we at first mistook nitidine chloride and nitidine iodide for salts of dihydronitidine. Thus the hydriodide and hydrochloride reported in our preliminary note [1b] are actually the iodide and the chloride. Both nitidine iodide and nitidine chloride on being heated yield a compound, $C_{20}H_{15}O_4N$, m. p. 285—286°. We have evidence that this compound may not be the expected 6 : 7-dimethoxy-2′ : 3′-methylenedioxybenzophenanthridine, and it is being further investigated. The authentic dihydronitidine hydrochloride and dihydronitidine hydrogen sulphate have been prepared under argon.

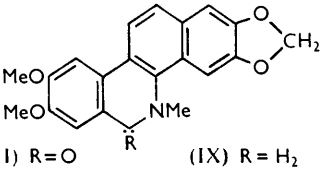


(I) R = H_2. (II) R = O

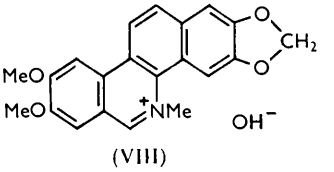


(III) R = O. (IV) R = H_2

(V) R = H_2. (VI) R = O



(VII) R = O (IX) R = H_2



(VIII)

The benzophenanthridine alkaloids previously reported are listed by Manske and Holmes.[5] All are substituted in the 7 : 8 : 2′ : 3′-positions whereas nitidine and oxynitidine are substituted in the 6 : 7 : 2′ : 3′-positions, and this seems to be the first reported certain variation in substitution, although methoxychelidonine, of undetermined structure, could be trisubstituted in the 6 : 7 : 8-positions.

A benzophenanthridine alkaloid (chelerythrine) was reported,[6] for the first time from a *Zanthoxylum* species, in 1953.

Since small amounts of oxynitidine are obtainable from plant extracts which were neither treated with alkali nor chromatographed we have called oxynitidine an alkaloid. It could, however, be an artefact.

Experimental

Analyses were by Dr. Zimmermann, Melbourne. The alumina used for chromatography was B.D.H. analysis grade. Light petroleum refers to the fraction, b. p. 60—80°. Unless otherwise stated, m. p.s were taken on a Kofler block; where stated to have been taken on a gas-heated copper block the m. p.s are uncorrected.

Isolation of Products.—(a) *Root bark.* Milled root bark (3 kg.) was extracted with hot methanol (17 l.) for 25 hr. The extract was concentrated to ½ l., then left for a few days. The yellow crystalline mixture (4·0 g.) was collected, then extracted with boiling water. The residue (0·8 g.) contained oxynitidine; basification of the aqueous extract with ammonia gave a buff-coloured precipitate (2·5 g.).

[5] Manske and Holmes, " The Alkaloids," New York, Academic Press, 1954, Vol. IV, 253.
[6] Cannon, Hughes, Ritchie, and Taylor, *Austral. J. Chem.*, 1953, **6**, 86.

(b) *Root wood.* Milled root (2 kg.) was extracted and worked-up as stated under (a); a buff-coloured precipitate (3·0 g.) was obtained.

Separation of Oxynitidine (VII) *and Dihydronitidine* (IX).—The buff-coloured precipitate (3·0 g.) was dissolved in hot benzene. The brownish rosettes (0·5 g.) which separated gave, after two recrystallisations from ethanol, colourless fine silky needles of *oxynitidine*, m. p. 284—285°, $[\alpha]_D^{20}$ 0·0° (*c* 0·43 in $CHCl_3$) (Found: C, 69·4; H, 4·7; N, 3·6; OMe, 16·0; NMe, 7·1. $C_{21}H_{17}O_5N$ requires C, 69·4; H, 4·7; N, 3·9; 2OMe, 17·1; 1NMe, 7·9%), $\lambda_{max.}$ in ethanol (log ε in parentheses) 367 (3·63), 333 (4·18), 320 (4·20), 288 (4·81), 277 (4·72), 251 mμ (4·59). (Solutions of oxynitidine had a purple fluorescence in ultraviolet light. With concentrated sulphuric acid, oxynitidine gave a red colour which became purple on warming of the solution.) The benzene filtrate was chromatographed on alumina (250 g.) under argon. Elution with benzene gave a product (0·8 g.) which after recrystallisation from ethanol under argon yielded colourless elongated prisms of *dihydronitidine*, m. p. 221—223°, $[\alpha]_D^{15}$ 0·0° (*c* 0·49 in $CHCl_3$) (Found: C, 71·5; H, 5·6; N, 4·2; OMe, 17·2; NMe, 7·3%; *M*, 363. $C_{21}H_{19}O_4N$ requires C, 72·2; H, 5·5; N, 4·0; 2OMe, 17·8; 1NMe, 8·3%; *M*, 349), $\lambda_{max.}$ in ethanol (log ε in parentheses) 311 (4·29), 278 (4·54), 228 mμ (4·61). (Solutions of dihydronitidine had a blue fluorescence in ultraviolet light; they rapidly changed from colourless to yellow in air. With concentrated sulphuric acid dihydronitidine gave a colour identical with that from oxynitidine.) Elution with benzene–chloroform (3 : 2) gave oxynitidine (0·7 g.), m. p. 284—285° after two recrystallisations from ethanol.

Salts of Dihydronitidine.—(a) *The hydrogen sulphate.* Dihydronitidine (0·3 g.) was dissolved in chloroform (10 ml.), and the solution was shaken under argon with 6N-sulphuric acid (10 ml.) in a separatory funnel. A white precipitate of the *hydrogen sulphate* (0·4 g.) which was formed at the interface was collected under argon and washed with ethanol under argon. It had m. p. 290—292° (decomp.) (gas-heated copper block) (Found: C, 50·4; H, 5·5; N, 2·8; S, 6·3. $C_{21}H_{19}O_4N,H_2SO_4,3H_2O$ requires C, 50·3; H, 5·4; N, 2·8; S, 6·4%).

(b) *Hydrochloride.* Dihydronitidine (0·2 g.) was dissolved in chloroform (10 ml.), and concentrated hydrochloric acid (2 ml.) was added. No precipitate was observed. When the chloroform was distilled under argon, the colourless needles (0·25 g.) which separated were collected under argon and washed with ethanol under argon. The *hydrochloride* had m. p. 215—216° (decomp.; vac.) (gas-heated copper block) (Found: C, 56·0; H, 6·0; N, 3·0; Cl, 8·1. $C_{21}H_{19}O_4N,HCl,4H_2O$ requires C, 55·1; H, 6·0; N, 3·1; Cl, 7·8%).

The above two colourless salts in the solid state or in solution rapidly became yellow; their solutions then gave a precipitate with potassium cyanide solution.

(c) *Methiodide.* Dihydronitidine methiodide was difficult to obtain. After several attempts at preparation, all of which failed to give a pure product, the following method was adopted: dihydronitidine (0·05 g.) was heated with methyl iodide (70 ml.) in a sealed tube for 2 weeks on the steam-bath. Distillation of the methyl iodide left an orange methiodide which after crystallisation from methanol under argon separated as orange needles, m. p. 268° (Found: C, 55·0; H, 4·2; N, 3·0. Calc. for $C_{21}H_{19}O_4N,CH_3I$: C, 53·8; H, 4·5; N, 2·9%). This product dissolved readily in water and had a sharp m. p.; we were unable to obtain a purer product.

Dihydronitidine from Oxynitidine.—(*a*) Oxynitidine (0·7 g.) was dissolved in hot phosphorus oxychloride (10 ml.), and the solution was heated at 105—110° for 3 hr.; excess of phosphorus oxychloride was removed at reduced pressure and water was added to the residue. A yellow precipitate (0·65 g.), m. p. 230—235°, was formed. This crude product was added gradually to a suspension of zinc dust in hot 3N-hydrochloric acid. The yellow colour disappeared. The mixture was filtered hot and the precipitate formed on cooling was extracted with chloroform. Removal of the chloroform gave a brown residue (0·3 g.) which crystallised from ethanol. Yellow needles, which, on further recrystallisation had m. p. 283—286° (after becoming colourless at about 240°) (gas-heated copper block), of nitidine chloride, separated. The mother-liquor deposited light brown prisms, m. p. 213—220°, which, after chromatography in benzene over alumina and recrystallisation from ethanol gave colourless elongated prisms of dihydronitidine, m. p. 220—222° (Found: C, 72·1; H, 5·3; N, 3·9; OMe, 17·9%).

(*b*) Oxynitidine (0·5 g.) was dissolved in toluene (120 ml.). Zinc amalgam (5 g.), water (20 ml.), and concentrated hydrochloric acid (40 ml.) were added, and the mixture was boiled under reflux for 10 hr. with occasional addition of zinc amalgam and hydrochloric acid. The aqueous layer was extracted with chloroform, from which extract a trace of dihydronitidine, m. p. 218—221°, was obtained. Oxynitidine was recovered from the toluene.

(*c*) To oxynitidine (0·5 g.) dissolved in sodium-dried tetrahydrofuran (50 ml.), lithium aluminium hydride (0·25 g.) was added. The mixture was heated under reflux in an atmosphere of argon for 3 hr. A little dilute hydrochloric acid was added, and then the organic phase was separated and diluted with water. The colourless precipitate was collected and after recrystallisation from ethanol yielded elongated prisms (0·4 g.), m. p. 220—222°, alone or in admixture with dihydronitidine.

Oxynitidine from Dihydronitidine.—To a solution of dihydronitidine hydrochloride (0·1 g.) in hot water (20 ml.) was added a hot solution (10 ml.) of potassium ferricyanide (0·2 g.) and potassium hydroxide (0·1 g.). The precipitate (0·08 g.) which was formed immediately was collected and recrystallised from ethanol. Colourless needles, m. p. 283—285°, alone or in admixture with oxynitidine, were obtained.

Salts of Nitidine.—(a) *Acetate.* Dihydronitidine (0·5 g.) was dissolved in hot 50% acetic acid (100 ml.). Mercuric acetate (2·0 g.) was added and the mixture was heated on the steam-bath for 2 hr. Precipitation began in the hot solution. The precipitate was collected after the solution cooled and hydrogen sulphide was passed into the mother-liquor. The black mixture obtained was filtered and sodium acetate was added to the filtrate. The organic product, which was salted out, was collected, and on recrystallisation from alcohol it deposited yellow needles of *nitidine acetate* (0·2 g.), m. p. 255—260° (Found: C, 58·1; H, 6·1; N, 3·0. $C_{23}H_{21}O_6N,4H_2O$ requires C, 57·6; H, 6·1; N, 2·9%). This product was very soluble in cold water, and the aqueous solution gave a colourless precipitate with potassium cyanide solution. An aqueous solution of nitidine acetate was basified with ammonia. From the precipitate so obtained, dihydronitidine, m. p. 218—220°, and oxynitidine, m. p. 280—282°, were isolated by the chromatographic method used to separate these two products from the precipitate obtained on basifying the crude nitidine salt from the plant.

(b) *Chloride.* Dihydronitidine (0·6 g.) was dissolved in ethanol (800 ml.). Concentrated hydrochloric acid (3 ml.) was added and the mixture, open to the air, was warmed on the water-bath for ½ hr. The solution was concentrated and a very pale yellow precipitate (0·4 g.) consisting of prisms and needles appeared on cooling. Repeated recrystallisation of this product from ethanolic hydrochloric acid gave bright yellow needles of *nitidine chloride* (Found: C, 60·8; H, 5·3; N, 3·6; Cl, 8·8. $C_{21}H_{18}O_4NCl,2H_2O$ requires C, 60·1; H, 5·1; N, 3·3; Cl, 8·5%). The mother-liquor (above) on concentration gave the same product as bright yellow needles.

(c) *Iodide.* A solution of dihydronitidine in ethanol was treated with hydriodic acid. The *product* was isolated as yellow needles in the way stated for the chloride (Found: C, 52·4; H, 4·0; NMe, 6·6; I, 25·4. $C_{21}H_{18}O_4NI$ requires C, 53·1; H, 3·8; 1NMe, 7·0; I, 26·7%).

Both nitidine chloride and nitidine iodide, on being heated to about 240°, changed to colourless needles of a *substance*, m. p. 285—286° (Found: C, 72·1; H, 4·6; N, 4·4. $C_{20}H_{15}O_4N$ requires C, 72·1; H, 4·5; N, 4·2%).

(d) *ψ-Cyanide.* The yellow crystalline mixture (0·2 g.) obtained from the methanol extract of the plant was dissolved in water. Potassium cyanide solution was added. The colourless precipitate (0·1 g.) was collected and recrystallised from benzene. Plates of the *ψ-cyanide*, m. p. 215—216°, m. p. 234° (decomp.; vac.) (gas-heated copper block), were deposited (Found: C, 70·6; H, 4·9; N, 7·6; OMe, 16·2. $C_{22}H_{18}O_4N_2$ requires C, 70·6; H, 4·8; N, 7·5; 2OMe, 16·6%). This product was obtained likewise from nitidine chloride.

(e) *Periodide.* To a boiling solution of dihydronitidine (0·3 g.) in ethanol (400 ml.) was added a solution of iodine (1·0 g.) in ethanol. Dark red-brown needles (0·5 g.) of *nitidine periodide*, m. p. 292—294°, raised by recrystallisation from acetone to m. p. 300—301° (decomp.) (gas-heated copper block), were formed (Found: C, 35·1; H, 2·6; I, 51·3. $C_{21}H_{18}O_4NI_3$ requires C, 34·6; H, 2·5; I, 52·2%). Prolonged heating of the periodide in acetone gave nitidine iodide.

6 : 7 : 2′ : 3′-*Tetramethoxy*-10-*methyl*-1 : 2-*benzophenanthrid*-9-*one* (A).—Phloroglucinol (2·7 g.) was dissolved in 50% sulphuric acid (150 ml.). Oxynitidine (2·5 g.) was added to the hot solution which was boiled for ½ hr., then heated on a steam-bath for 5 hr. Then an equal volume of water was added, and the mixture was left overnight. A deep reddish precipitate (3·0 g.) was deposited, which, after removal of some red insoluble material, yielded on several crystallisations from ethanol, fine light brown needles, m. p. 292—294°, which gave a deep greyish-green colour with ferric chloride solution and a negative Labat methylenedioxy-test. This product was methylated with diazomethane in ether during one week, fresh diazomethane being added

daily. (Later, a smooth methylation in tetrahydrofuran for 12 hr. was found superior.) The *product*, after two recrystallisations from ethanol, separated as needles, m. p. 251—253° (Found: C, 69·6; H, 5·6; OMe, 32·9. $C_{22}H_{21}O_5N$ requires C, 69·6; H, 5·6; 4OMe, 32·7%).

9 : 10-*Dihydro*-6 : 7 : 2′ : 3′-*tetramethoxy*-10-*methyl*-1 : 2-*benzophenanthridine* (B).—(*a*) The tetramethoxy-*N*-methylbenzophenanthridone (0·3 g.) and phosphorus oxychloride (7 ml.) were boiled under reflux on an oil-bath for 3 hr. The yellow precipitate obtained when this mixture was poured into water was suspended in 30% hydrochloric acid (40 ml.). Zinc (2·0 g.) was added and the mixture was heated on the steam-bath for 6 hr. with occasional addition of zinc and hydrochloric acid. The product was extracted with chloroform and finally crystallised from methanol. As it did not melt sharply, it was boiled in methanol with sodium borohydride (0·3 g.) for 1 hr. After isolation by the usual procedure the product was recrystallised from methanol. Colourless prisms (0·1 g.), m. p. 216—218°, of 9 : 10-*dihydro*-6 : 7 : 2′ : 3′-*tetramethoxy*-10-*methyl*-1 : 2-*benzophenanthridine* (B) separated (Found: C, 72·1; H, 6·3; OMe, 33·7. $C_{22}H_{23}O_4N$ requires C, 72·3; H, 6·3; 4OMe, 34·0%). This product was unchanged after chromatography in benzene on alumina.

(*b*) Lithium aluminium hydride (0·25 g.) was added to the tetramethoxy-*N*-methylbenzophenanthridone in tetrahydrofuran, and the mixture under argon was boiled under reflux on the steam-bath for 3 hr. A little dilute hydrochloric acid was added and then the supernatant liquid was decanted and evaporated to dryness under argon. On recrystallisation of the residue from ethanol, lozenge-shaped crystals, m. p. 216—218° alone or in admixture with the product (B) from (*a*), were obtained.

(*c*) The methosulphate of 6 : 7 : 2′ : 3′-tetramethoxy-1 : 2-benzophenanthridine (0·3 g.) was suspended in 3% hydrochloric acid (45 ml.) with zinc (6·0 g.). The mixture was boiled under reflux for 8 hr. during which concentrated hydrochloric acid (3·0 ml.) was added after each 2-hourly interval; the yellow salt dissolved. A pale yellow precipitate appeared after the mixture had been cooled at 0—5° overnight. This was collected and treated with 5N-ammonia, and the mixture was then extracted with chloroform. The chloroform extract was washed with water, dried ($MgSO_4$), and then evaporated to dryness under argon. The residue (0·06 g.) was crystallised from ethanol. Lozenge-shaped crystals of compound (V), m. p. 211—212°, raised to m. p. 216—218·5° on further recrystallisation from ethanol, were obtained (Found: C, 72·1; H, 6·2; N, 4·1; OMe, 33·9%). This product did not depress the m. p. of product (B) from (*a*). The products had identical infrared spectra.

9 : 10-*Dihydro*-7 : 8 : 2′ : 3′-*tetramethoxy*-10-*methyl*-1 : 2-*benzophenanthridine* (IV).—Chelerythrine chloride (1·0 g.) was converted into dihydrochelerythrine (0·6 g.) and this was demethylenated and then methylated as given under the preparation of 6 : 7 : 2′ : 3′-tetramethoxy-10-methyl-1 : 2-benzophenanthridone. After recrystallisation from ethanol it had m. p. 190—192° (Späth and Kuffner [3] give m. p. 182—183°; Bailey, Robinson, and Staunton [4] give m. p. 183·5—185°). Its m. p. was depressed to 180—190° in admixture with 9 : 10-dihydro-6 : 7 : 2′ : 3′-tetramethoxy-10-methyl-1 : 2-benzophenanthridine.

7 : 8 : 2′ : 3′-*Tetramethoxy*-10-*methyl*-1 : 2-*benzophenanthridone* (III).—The preceding product (0·5 g.) was treated with alkaline potassium ferricyanide as stated for the oxidation of dihydronitidine. The *product* (0·4 g.) on recrystallisation from ethanol had m. p. 223—225° (Found: C, 69·7; H, 5·8; N, 3·7; OMe, 32·9; NMe, 6·6. $C_{22}H_{21}O_5N$ requires C, 69·7; H, 5·5; N, 3·7; 4OMe, 32·7; 1NMe, 7·5%). Its m. p. was depressed to 218—230° on admixture with 6 : 7 : 2′ : 3′-tetramethoxy-10-methyl-1 : 2-benzophenanthridone.

N-*Methyl*-m-*hemipinimide*.—(*a*) Oxynitidine (0·5 g.) was dissolved in hot stabilised glacial acetic acid (250 ml.), and a 5% aqueous solution (50 ml.) of potassium permanganate was added during 15 min. After it was cooled the mixture was decolorised with sulphur dioxide. The inorganic salts were collected and the yellow filtrate was evaporated to dryness under reduced pressure. The residue thus obtained was extracted with boiling benzene (3 × 400 ml.). The combined benzene extracts were concentrated to 100 ml. and then diluted with an equal volume of light petroleum (b. p. 40—60°). This solution was then chromatographed on alumina. Elution with benzene–petroleum (1 : 1) gave in the first fractions (400 ml. of eluate) a product (0·014 g.) which separated on recrystallisation from ethanol as colourless prisms, m. p. 215—216° (decomp.), m. p. 254—256° (vac.) (gas-heated copper block) of *N*-methyl-*m*-hemipinimide (Found: C, 59·5; H, 4·8; N, 7·1; OMe, 26·9. Calc. for $C_{11}H_{11}O_4N$: C, 59·7; H, 5·0; N, 6·3; 2OMe, 28·0%). In ultraviolet light this product, in solution, had a purple fluorescence, and, on the chromatographic column, a green fluorescence. Continued elution gave in the next

300 ml. of eluate a product, m. p. 272°, which gave a positive test for methylenedioxy-groups and had no fluorescence in ultraviolet light. It was not further investigated.

(*b*) By the method of Edwards *et al.*,[7] veratraldehyde was converted into veratric acid, and the latter was converted into *m*-meconine. Oxidation of *m*-meconine gave *m*-hemipinic acid. This acid (0·5 g.) was heated at 175—185° for 20 min., and the anhydride so obtained was dissolved with fused sodium acetate (1·5 g.) and methylamine hydrochloride (0·8 g.) in glacial acetic acid. The mixture was heated under reflux for 20 min., then allowed to cool. The inorganic salts which separated were collected, and from the filtrate the crude product separated on cooling. This was filtered through alumina and then recrystallised from ethanol. Colourless prisms, m. p. 256—258° (vac.) (gas-heated copper block) alone or in admixture with the product from (i), separated (Found: C, 59·7; H, 5·0; N, 6·3; OMe, 27·8%). The products (*a*) and (*b*) had identical infrared spectra. In ultraviolet light the product in ethanol solution had a green fluorescence, and in benzene solution a blue fluorescence.

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[7] Edwards, Perkin, and Stoyle, *J.*, 1925, 195.