

XVII.—*On an Alkaloid obtained from Jaborandi, its Platinic Compound, and their Formulæ.*

By CHARLES T. KINGZETT.

IN 1875 an alkaloid was isolated from the leaves and stalks of jaborandi (*Pilocarpus pennatifolius*, of Lemaire), almost simultaneously and quite independently by Mr. A. W. Gerrard and M. Hardy. There is another kind of jaborandi, a species of *Piper*, from which Parodi has isolated an alkaloid of the formula, $C_{20}H_{12}N_2O_6$.

To the alkaloid upon which M. Gerrard worked, the name of pilocarpine has been given. He has detailed the methods of extraction, and states that it forms crystallisable salts with hydrochloric, nitric, and sulphuric acids. He further exhibited some crystals of the so-called hydrochloride in a dark brown mother-liquor, at the last meeting of the Pharmaceutical Conference, but neither at that time nor since has he, or M. Hardy, or any other observer, published any formulæ for the alkaloid or its compounds. Mr. Gerrard has further stated his opinion that there are at least two alkaloids in jaborandi, and that the one upon which he worked gave no precipitate with phosphomolybdic acid. Several other papers relating to this subject will be found in the *Year Book of Pharmacy*, for 1875.

More recently Hardy states that he has obtained from the distillate

of an aqueous extract of the leaves of jaborandi, a quantity of crude oil, containing a terpene which gave a crystalline di-hydrochloride. But the boiling point of 178°C. , which he attributes to the hydrocarbon, would rather point to cymene than to a terpene. He also obtained a solid, colourless substance, which was not further examined (*L'Union Pharmaceutique*, vol. xvi, p. 365). My first experiment was conducted upon the leaves of the plant. These were thoroughly extracted with water of 70°C. , and the extract concentrated to a small bulk, filtered from deposited matters, rendered acid by hydrochloric acid, and fully precipitated with phosphomolybdic acid. The bright yellow precipitate, after thorough washing, was decomposed after the method of Sonnenschein, that is by heating with excess of baryta, and the excess of barium was removed by carbonic acid. The filtrate was strongly alkaline, and was found to contain barium. This barium was carefully removed by sulphuric acid, and the filtrate, which gave the characteristic reactions of an alkaloid with various reagents, was converted into hydrochloride, but all attempts to obtain crystals by concentration on a water-bath, or in a vacuum over sulphuric acid, or by spontaneous evaporation, proved vain.

In the next experiment I took the stems and twigs of jaborandi, and extracted them after they had been cut up into small fragments, with boiling water, until the last extract contained no appreciable quantity of matter.

The extract was distilled to a small bulk, and it was observed that the first few litres of distillate came over milky, and that on standing yellow oily drops deposited. The small quantity and its volatile nature defeated an attempt made to isolate it. The concentrated water-extract obtained as above was treated with an equal volume of strong alcohol, which threw down dark-coloured albuminous matter, &c. From the filtrate the whole of the alcohol was distilled off, and a great part of the water. The syrup of 300 c.c. was now extracted with much ether. Next ammonia was added, as Mr. Gerrard stated in a letter to me that he had found the alkaloid in the water extract was combined with an acid, and the whole was again extracted with ether. Finally the syrup containing ammonia was extracted with chloroform.

The first ether extracts were strongly coloured; the after ones only faintly; the chloroform ones not at all. From all these extracts the solvents were distilled, and after many and various unsuccessful attempts to get the residues combined separately in a crystalline form with hydrochloric acid, no sign of crystallisation ever being obtained, all the products were united, ammonia added, and the whole again extracted by chloroform. The chloroform extracts on distillation left a coloured aqueous syrup, which was rendered strongly acid with nitric

acid, and gave a bulky yellow precipitate with phospho-molybdic acid. This precipitate was passed through the same treatment as that described above in the first experiment. The free base was found to contain barium, which was removed exactly by very dilute sulphuric acid, after which the whole was concentrated to a syrup of a pleasant nutty odour. The product was now acidified faintly with hydrochloric acid, and another attempt made to get a crystallisation, both by evaporation on a water-bath and *in vacuo*, &c., but as before, quite in vain.

I therefore now removed the hydrochloric acid by dilution with water and agitation with oxide of silver, and evaporated the filtrate to dryness, after digestion with charcoal, which removed much of the colour. The residue was dissolved in absolute alcohol, filtered from a trace of reduced silver, and again evaporated to dryness, and the drying completed in an air-pump over sulphuric acid during a fortnight. The product was now analysed, all combustions being effected in platinum boats, as the matter was soft and plastic, like gum.

(a.) 0.0204 grm. gave by combustion *in vacuo* with CuO and metallic copper, 21.8 c.c. CO₂, and 1.8 c.c. N. normal, showing the relation of the N : C to be 1 : 6.

(b.) 0.1872 grm. gave by combustion with PbCrO₄ and metallic copper, 0.3762 grm. CO₂, and 0.1404 grm. H₂O = 54.80 per cent. carbon, and 8.33 per cent. hydrogen.

Synopsis of Analyses.

		÷ at. wgts.	÷ N = 1.
Frankland's process	C = 54.80	4.566	5.80
	H = 8.33	8.33	10.50
	N = 11.03	.787	1.0
	O = 25.84	1.615	2.0
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100.00			

After the above analysis was completed, the rest of the alkaloid was dissolved in 87 per cent. alcohol, and treated with alcoholic platinic chloride, when a bulky precipitate was produced, but slightly soluble in cold, readily soluble in hot water. The yellow solution on concentration gave a crop of reddish-yellow octohedral crystals, which were isolated, rinsed with water, dried at 80° C., and analysed.

(a.) 0.0404 grm. gave by combustion *in vacuo* with CuO and Cu, 26.2 c.c. CO₂, and 2.3 c.c. N normal, giving as the relation of N : C 1 : 5.7, and the percentage of N = 7.12.

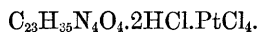
(b.) 0.3532 grm. gave with PbCrO₄ and metallic Cu 0.412 grm. CO₂, and 0.142 grm. H₂O = 31.81 per cent. C., and 4.46 per cent. H.

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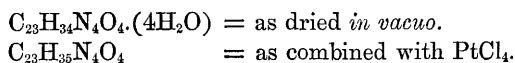
(c.) 0.2120 grm. gave 0.0496 grm. platinum, and 0.2128 grm. Agl = 23.39 per cent. Pt, and 24.83 per cent. Cl.

Synopsis of Analyses.

	÷ at. wghts.	÷ Pt = 1.	
C = 31.81	2.65	22.4	} or
H = 4.46	4.46	37.7	
N = 7.12	.508	4.3	
Pt = 23.39	.118	1.0	
Cl = 24.83	.669	5.6	
O = 8.39	.524	4.4	



Now the analysis of the free alkaloid led to $\text{C}_{5.6}\text{H}_{10.5}\text{NO}_2$. Multiplying this by 4, and deducting $4\text{H}_2\text{O}$, we obtain the above formula derived from the analyses of the platinum salt:—



In conclusion, I have to express my indebtedness to Dr. Thudichum for having kindly placed his laboratory at my disposal during the prosecution of the foregoing research.