LETTERS TO THE EDITOR

Catechols and Tryptamines in the "matoke" Banana (*Musa paradisiaca*)

SIR,—Varieties of *Musa paradisiaca* are grown abundantly in Uganda, where the pulp of the unripe fruit, known as "matoke", when boiled forms the staple diet of the Buganda tribe. As relatively large amounts of catechols and tryptamines have been found in the varieties of banana eaten in Britain, it seemed important to find out if the "matoke" banana also contains these amines.

A sample of the bananas was kindly supplied by Professor Heller of Bristol. The fruit had been stored in deep freeze since its arrival from East Africa by refrigerated transport. The sample was sent to Dundee in a vacuum flask containing solid CO_2, where it was again stored in deep freeze until extraction of the amines. Catechol amines were extracted from half the sample with 0·01 HCl; the other half was extracted with acetone for tryptamines. The extracts were reduced to small volume by distillation *in vacuo*. Catechols were assayed on the cat blood pressure, 5-hydroxytryptamine (5-HT) on the isolated rat uterus.

	Catechols (μg./g.)		5-Hydroxytryptamine (μg./g.)
	Noradrenaline	Adrenaline	
Peel	1·79	nil	1·07
Pulp	2·00	nil	16·2

The results show that the "matoke" banana contains noradrenaline in amount similar to that found in the ordinary banana[1], but there was no adrenaline in the sample studied. There was a considerable amount of 5-HT in the pulp, but much less in the peel. Since the fruit was unripe, this agrees with the observations of West[2] on the ordinary banana. Chromatography of the acetone extract confirmed the presence of 5-HT and showed the absence of tryptamine, tryptophan and 5-hydroxytryptophan.

In view of the large quantities of "matoke" banana pulp eaten by the Africans in Uganda (several pounds weight per day), the amount of 5-HT found might constitute a contributory factor in intestinal disorders.

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The Determination of Morphine in Opium

SIR,—A few years ago a modified Mannich method[1], utilising an extraction procedure suggested by Graf[2], was proposed for the determination of morphine in opium. Lately, the method has been critically examined, and some improvements introduced[3].

Most analyses of opium samples present no difficulties by this method. In a few, however, the method fails to give reproducible results.

The original procedure[1] involves exhaustive extraction of an opium, rendered alkaline, with chloroform-*iso*propanol, from which solution the morphine is extracted by shaking with 20 + 15 + 15 ml. of 0·1 N solution of sodium hydroxide. The combined aqueous extracts, neutralised with hydrochloric acid, are concentrated on a steam bath to 30 g. before the morphine is precipitated as the dinitrophenyl ether by adding 30 ml. of a 1 per cent (w/w) solution of fluordinitrobenzene, followed by 5 ml. of 25 per cent solution of ammonia. The isolated morphine-ether is better washed with acetone only, as shown by Garratt and his colleagues[3].

The non-reproducibility mentioned, sudden "drops" by up to 20 per cent being observed, is supposed to be due to the heating of the slightly acid opium extract. Omitting the concentration of the opium extract, using the following simplified procedure, the reproducibility has been restored. The morphine is extracted as the phenolate from the chloroform-*iso*propanol solution by shaking with 15 + 10 + 10 ml. of 0·1 N solution of sodium hydroxide. Each time the separator is rinsed with 5 ml. of water. The bulked aqueous extracts and washings (50 ml.) are buffered to pH 6 by dissolving 0·50 g. of citric acid, and the morphine-ether is precipitated with 50 ml. of the reagent solution. Continue as above.

As 100 ml. of a 50 per cent (v/v) mixture of acetone and water dissolves 8 mg. of the morphine dinitrophenyl ether, the results obtained by the new procedure are estimated to be about 5 per cent low, calculated with reference to an opium containing 10 per cent of morphine. It is of interest, then, to report some results from morphine determinations by this procedure, as well as by the method adopted by the International Pharmacopoeia, Ed. I.

TABLE I

ANALYSIS OF OPIUM

Sample of opium	Per cent anhydrous morphine			
	Proposed method		Ph. I. Ed. I.	
Number 1	11·05*		10·8	10·8
			10·8	10·8
Number 2 (Yugoslavian)	17·8	17·8	17·3	
	17·8		17·3	
Number 3	15·1	15·4	14·1	13·8
	15·4	15·5	14·1	
Number 4 (Yugoslavian)	11·3	11·6	11·2	
	11·4	11·6	11·0	
	11·5	11·5		
	11·4	11·5		
Number 5 (Yugoslavian)	16·9	17·3	16·5	
	17·1	17·5	16·5	
	17·1	17·4		
	17·0	17·4		

* Mean of 11 determinations standard deviation 0·16.

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