

Cacao Tannin

THE method most commonly used for the estimation of cacao tannin is by precipitation with cinchonine sulphate^{1,2,3}. Duthie⁴ found that the filtrate from the cinchonine tannate gave a precipitate on refluxing with formaldehyde and hydrochloric acid (Stiasny reagent). He suggested that this precipitate is a measure of catechin and similar phenolic compounds.

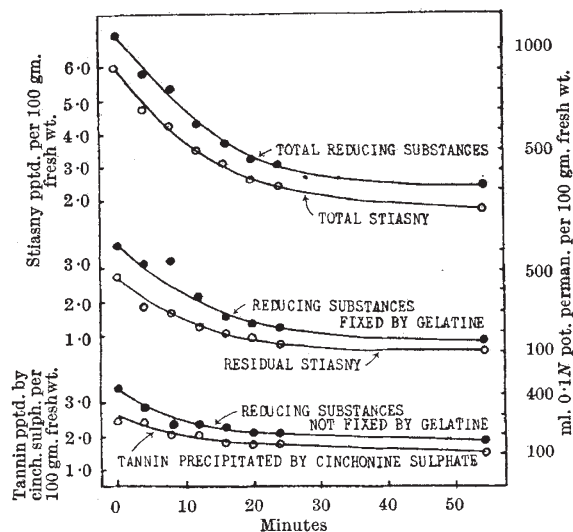
During some experiments in which freshly picked cacao beans were minced and allowed to autolyse, it was found that the amount of tannin, extracted with 40 per cent acetone and precipitated by cinchonine sulphate, decreased progressively with time and that the Stiasny precipitate of the filtrate (residual Stiasny precipitate) decreased proportionally. A Stiasny determination (total Stiasny precipitate) on an aliquot of the original tannin solution yielded a precipitate which was approximately equal to the sum of the cinchonine tannin and the residual Stiasny precipitate (cf. Duthie⁴). These results suggest that the cinchonine sulphate acts selectively on the tannin molecule and combines with a part of it, or that two substances are present, one yielding a precipitate with cinchonine sulphate and the other a Stiasny precipitate, and both substances decrease proportionally with time. The latter explanation seems less likely.

Tannin determinations were also made by a Lowenthal procedure⁵. The amount of tannin estimated by this method (that is, reducing substances fixed by gelatine) was found to run parallel to the residual Stiasny determinations, while the amount of the total substances oxidizable by potassium permanganate closely followed the changes in the amount of total Stiasny precipitate, and the amount of reducing substances not fixed by gelatine followed the changes in amount of tannin precipitated by cinchonine sulphate. It thus appears that in the case of cacao, the cinchonine sulphate reacts with one part of the tannin molecule while gelatine reacts with the other part.

Evidence in support of the above explanation was obtained by making Stiasny determinations on the filtrate from solutions of cacao tannin treated with gelatine and sodium chloride. The values obtained corresponded to the amount of tannin precipitated by cinchonine sulphate from the original solutions.

In this connexion it may be recalled that Smith⁶, working with tea infusions, found that the filtrate from the cinchonine tannate gave a colour and precipitate on addition of ferric salts but he was unable to identify the substance responsible. Chapman⁷ reported that in the case of hops, the cinchonine tannate filtrate gave a colour with ferric chloride.

Hitherto the results obtained from the two methods of determining tannins have shown little agreement and the above observations offer an explanation and appear to throw fresh light on the structure of the cacao tannin molecule. The cinchonine sulphate and Lowenthal methods may be brought into agreement, so far as cacao is concerned, by taking into account the total Stiasny precipitate, the residual Stiasny precipitate and the cinchonine sulphate precipitate in the one method, and the total reducing substances, reducing substances fixed by gelatine and the reducing substances not fixed by gelatine, in the other method. Certain non-tannin materials which are oxidized by permanganate are present in the cacao bean, but these are very small in amount compared with the amount of tannin. These methods may be



applicable to tannin determinations in other plant material if the amount of non-tannin reducing material is known.

E. C. HUMPHRIES.

Imperial College of Tropical Agriculture,
Trinidad, B.W.I.
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¹ Hooper, D., *Analyst*, **50**, 162 (1925).

² Jensen, H. R., *Analyst*, **53**, 365 (1928).

³ Adam, W. B., *Analyst*, **53**, 369 (1928).

⁴ Duthie, D. W., *Analyst*, **63**, 27 (1938).

⁵ Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists, 5th ed., 199 (1940).

⁶ Smith, H. L., *Analyst*, **38**, 312 (1913).

⁷ Chapman, A. C., *Analyst*, **38**, 315 (1913).

A Transverse Zoo-geographical Barrier on the East Side of Lake Tanganyika

No outstanding discontinuity of animal distribution as one proceeds from north to south down the east side of Lake Tanganyika would be inferred from most maps of the region. It is obvious only that along much of the Lake shores the land rises to above 5,000 ft., which has been generally accepted as the approximate lower level of the Highland life-zone in Central Africa. The latest maps¹, which are a great advance on their predecessors, show plainly that on the east side of the Lake the highland country falls into three parts: (a) the narrow strip north of Kigoma, which, through Urundi, is continuous with the Kivu and Mufumbiro mountain area, and on the south is separated by the depression centring round the Malagarasi River from (b) the much-dissected Kungwe, Mahari, Baholoholo high country, separated on the south by the low gap round Karema from (c) the Ufipa Plateau, which is continuous with the highlands on the Northern Rhodesian border and round the head of Lake Nyasa.

A study of the 1/1 mill. map¹ shows that in width the Malagarasi Depression and the Karema Gap are similar, the distance in both between any considerable areas over 5,000 ft. being about eighty miles, but the Karema gap has the flatter bottom, with more of it below 4,000 ft. Looking from the shore of Lake Tanganyika, one gains a strong impression of the Karema gap as a corridor running eastwards,