On the Biochemical Study of the Ripening of the Kaki-Fruit,[1] VII.

By

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I. ARE THERE ANY DIFFERENCES IN CHEMICAL COMPOSITION BETWEEN THE ASTRINGENT AND SWEET VARIETIES?

On comparing the ultimate analysis of both varieties mentioned in Sawamura's article, one of the authors (S. K.) and H. Ueda[2] are inclined to believe that there was no marked difference in the composition.

When, however, comparing the percentage composition of sugars, pectin, shibu and acids in the pulp of both fruits, the difference to distinguish one from the other came to our notice.

For comparison, the authors have made the analysis of three strains of the sweet variety and of four strains of the astringent one, all grown on the same ground at Tanaka, Kyoto[3]. Three fruits were picked from each tree at a different stage of growth, and were analysed as usual. In Table I, all of the figures are the percentage distribution

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1 The expenses of this investigation were shared by the Government Department of Education.

2 J. Biochem., **1**, 181 (1922).

3 Refer second article, S. Komatsu and H. Ueda: J. Biochem., **2**, 291 (1922), Fifth article, S. Komatsu and M. Ishimasa: Ibid., 3, (1924); and Sixth article, S. Komatsu and M. Ishimasa: these Memoirs, 7, 165 (1924).

of the constituents of the fruit in the pulp, and those in Table II. are the mean value of the percentage composition of the constituents in each month.

Studying precisely the figures on the tables, the following conclusion were summarised.

(1) The astringent fruit, when it is young, contains less sugar and much pectin, shibu and acid compared with the sweet one picked in the same season.

(2) The sugar-content in the astringent fruit increases with greater velocity than in the sweet one, while the pectin-content in the former decreases much more than in the latter.

(3) The soluble shibu and acids-contents are rich in the astringent fruit, and moreover, the velocity of their disappearance in the astringent fruit is slow compared with that in the sweet one.

(4) The percentage composition of these substances in the two varieties, showed a marked difference in their unripe state, they, however, approarch very nearly to each other when the fruits have attained their maturity, actually no distinction being found between the two fruits in state.

II. ON THE CURING PROCESS.

Keeping a fruit dried and cured by the process was, in this country, usually regarded as the best way for its preservation.

On subjecting the fruit to a desiccating process, it was an important thing to bring the fruit to a suitable condition in the minimum time, preventing the consumption of sugars by respiration and by fermentation as far as possible. Since, as has been already shown, the full-grown astringent fruit was left to stand at the room-temperature for a while, not only was one part of the sugars in the fruit consumed by its respiration decomposing into carbon dioxide and water, but also by the fermentation transforming it into alcohol and

other substances[1].

To find the most suitable conditions for carrying out this purpose of preparing the fruit for drying, the following preliminary experiments were carried out with the fruit named " Daishiro " grown on Mr. Uno's farm, Tanaka.

(1) One ripe fruit weighing 74·5 grm. was divided into two parts, one part was soon analysed and the remainder was left without any treatment for 6 days in the laboratory.

The loss of sugar and of water in 6 days was 7·5% and 20·5% respectively, while the acid-content was increased (0·002 grm.) due to the fermentation of sugars.

(2) The peeled fruit was kept for 8 days in the laboratory, and then analysed, the results were compared with those of the whole fruit kept for 8 days for control under the same condition.

In the former, 4% of sugar and 17% of water, while in the latter 2% of sugar were lost, while the water-content in the latter remained constant. In both fruits sucrose was inverted completely into the reducing sugars, and it was confirmed that the acrid taste had disappeared.

(3) In the third experiment, one fruit was divided into two parts, one of which was peeled and analysed after keeping 8 days in the laboratory, and the results were compared with those of another half which was analysed, for control, soon after peeling. By this treatment, the loss of sugar and water was 17·5% and 48% respectively.

Consequently, it was concluded from the above statement that in the desiccating process the peeled fruit loses less sugar by respiration and by fermentation but much water by evaporation compared with the results of other treatments.

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1 Pasteur : C. R., **75**, 1056 (1872) ; Lechartier e. Bellamy : Ibid., **75**, 1204 (1872) ; **79**, 949 (1874) ; F. Czapeck : Biochem. Pflanzen., **1**, 422 (1913).

Table I.

ASTRINGENT VARIETY.

Daishiro.

Percentage in Pulp.

Date.	Reducing Sugar.	Cane Sugar.	Total Sugar	Pectin.	Shibuol.	Acid.	Water.
July 10.	3·24	0·40	3·63	—	—	—	—
„ 12.	3·29	0·33	3·61	2·23	1·54	0·24	80·9
Aug. 9.	4·01	2·13	6·13	1·75	1·61	0·18	81·1
Sep. 10.	4·51	3·44	7·94	1·82	1·56	0·15	81·7
Oct. 3.	7·36	3·45	10·80	—	—	—	—
„ 15.	10·68	0·60	11·28	1·16	0·65	0·09	81·3

Daishiro.

Percentage in Pulp.

Date.	Reducing Sugar.	Cane Sugar.	Total Sugar.	Pectin.	Shibuol.	Acid.	Water.
Sep. 27.	10·01	1·40	11·41	1·87	0·69	0·11	79·7
„ „	8·92	2·29	11·21	1·95	0·40	0·08	77·6
Oct. 22.	11·88	0·83	12·71	1·43	0·41	0·05	80·0

SWEET VARIETY.

Gosho-Gaki.

Percentage in Pulp.

Date.	Reducing Sugar.	Cane Sugar.	Total Sugar.	Pectin.	Shibuol.	Acid.	Water.
July 13.	3·39	1·29	4·68	1·72	0·86	0·17	80·0
Aug. 10.	4·08	2·86	6·95	1·73	0·31	0·09	81·1
Sep. 11.	4·76	4·26	9·03	1·44	0·16	0·06	82·5
Oct. 3.	5·76	4·46	10·22	—	—	—	—
„ 16.	8·29	3·62	11·91	1·49	—	0·08	80·3

Ansai.

Percentage in Pulp.

Date.	Reducing Sugar.	Cane Sugar.	Total Sugar.	Pectin.	Shibuol.	Acid.	Water.
Sep. 25.	6·88	3·18	10·65	1·99	0·60	0·05	80·6
Oct. 19.	9·15	2·19	11·34	1·32	—	0·06	80·0

Kubo-Gaki.

Percentage in Pulp.

Date.	Reducing Sugar.	Cane Sugar.	Total Sugar.	Pectin.	Shibuol.	Acid.	Water.
Oct. 1.	8·13	1·53	9·65	1·65	0·34	0·11	80·4
,, 23.	8·75	2·36	11·11	1·47	0·21	0·07	81·2

Table II.

Percentage in Pulp.

Month.	Total Sugar.		Pectin.		Shibuol.		Acids.	
	S.	A.	S.	A.	S.	A.	S.	A.
7	5	4	1·7	2·1	0·9	1·5	0·17	0·3
8	7	5·5	1·7	1·7	0·3	1·8	0·09	0·2
9	9·5	8·0	1·6	1·7	0·4	1·5	0·06	0·16
10	11	11	1·4	1·5	0·2	1·1	0·07	0·10

S. ..... Sweet variety

A. ..... Astringent variety.