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Kagoshima Univ. Res. Center S. Pac., Occasional Papers, No. 26, 9 - 13, 1995
Survey Team I, Report 3. The Progress Report of the 1994 Survey of the Research Project,
"Man and the Environment in Micronesia"

CHARACTERISTICS OF TROPICAL AND SUBTROPICAL FRUITS COLLECTED FROM POHNPEI ISLAND OF THE FSM

Shigeto TOMINAGA, Michio ONJO, Mitsuru HAYASHI, Adelino S. LORENS and Fumio HASHINAGA

Introduction

Many tropical and subtropical fruit trees were introduced to Japan from southern Asian countries including southern Pacific islands countries. Some of them, such as guava, passion fruit and mango are now grown in southern areas of Japan. Other fruit trees also have potential of utilization in southern Japan such as Kagoshima prefecture. Characteristics of such fruit trees especially fruit quality, however, have not been investigated.

Contrary to some belief, most of the introduced fruit did not originate from the Federated States of Micronesia and nearby southern Pacific islands. Most of these fruits were introduced to southern Pacific island countries such as Micronesian islands from the Indian sub continent and central, southern American countries which are the major centers of origin of many plant species (BEVACQUA, 1994). Some fruits, such as passion fruit, mango etc. were later introduced to the southern areas of Japan. The authors aimed to determine the distribution and utilization of tropical and subtropical fruit trees on Pohnpei Island of the Federated States of Micronesia. Fruit quality parameters such as sugar and acid constituents were also investigated.

Materials and Methods

The authors carried out surveys on the island of Pohnpei of the FSM and sampled fruit trees grown on the island. Sampling was carried out at five sites on Pohnpei Island as shown on Fig. 1. In total 15 fruit samples were collected, the tissues sampled, included fruit, leaves and flowers. At sampling time, morphological characteristics such as leaf shape, fruit weight, colour and plant growth habit were determined. Morphological classification was done based on classification of HOTTA *et al.* (1989) and IWASA (1974). Fruit quality analysis such as internal colour, seediness, seed number was done. Lastly, the samples were extracted for juice and total soluble solid content (Brix) was determined by a hand held refractometer. Titratable acidity was determined using neutralization methods by 0.156N-NaOH. Sugar separation carried out using high pressure liquid chromatography analyzer (Shimazu LC-6A) with an SCR101C column and water carrier using refractive index detector. Acids separation was also done by high pressure liquid chromatography analyzer (Shimazu LC-10A) with Shodex HC-125S column and 0.1% H_3PO_4 carrier using UV detector.

Results and Discussion

The results of the classification and native origin of the 15 samples of fruits that were collected from the 5 sites on Pohnpei Island are presented in Table 1. They were classified into 10 genera: *Syzygium* (3 species and 5 samples), *Averrhoa* (2 species and 2 samples), *Eugenia*

Fig. 1 Sampling locations for tropical and subtropical fruits in Pohnpei Island of the FSM.

(1 species 1 sample), *Flacourtia* (1 species 1 sample), *Malpighia* (1 species 1 sample), *Morinda* (1 species 1 sample), *Psidium* (1 species 1 sample), *Garcinia* (1 species 1 sample), *Passiflora* (1 species 1 sample) and *Pangium* (1 species 1 sample). In addition all collected materials were found to be introductions from nearby south east Asian countries and none originated from Pohnpei Islands (HOTTA *et al.*, 1989; IWASA, 1974; NAKAMURA *et al.*,1985).

The 15 samples were classified to 13 species and on Table 2 the following characteristics are presented: fruit type, diameter, fruit length, weight, peel colour, seed number, embryo colour, leaf type, serration, winginess, leaf blade length and width. The fruit types were classified as follows, Indian mulberry; multiple fruit, Egg tree and Pangi fruit; compound fruits, the remaining fruits were all classified as simple fruits. According to size, the largest fruit was Pangi which weighed up to 2kg, next were Carambola, Egg tree fruit and Malay apple which weighed about 100g, the remaining fruits were in the range between 3.9g

Table 1. Tropical and subtropical fruits collected from Pohnpei Island of the FSM

Number	Collected location (Fig.1)	Common name	Scientific name	Native country
1	A	Water rose apple	*Syzygium aqueum* ALSTON	India~Malay
2	C	Water rose apple	*Syzygium aqueum* ALSTON	India~Malay
3	B	Water rose apple	*Syzygium aqueum* ALSTON	India~Malay
4	D	Samarang rose apple	*Syzygium samarangense* MERRILL et PERRY	Malay~Andaman islands
5	D	Malay apple	*Syzygium malaccensis* MERRILL et PERRY	Malay
6	A	Pitanga	*Eugenia uniflora* LINN.	Brazil
7	A	Governor plum	*Flacourtia inermis* ROXB.	India~Malaysia
8	A	Bilimbi	*Averrhoa bilimbi* LINN.	Moluccas
9	A	Carambola	*Averrhoa carambola* LINN.	Malay~Moluccas
10	A	Acerora	*Malpighia emerginata* DC.	Tropic America
11	E	Indian mulberry	*Morinda citrifolia* LINN.	India~South Pacific island
12	E	Guava	*Psidium guajava* LINN.	Tropic America
13	A	Egg tree	*Garcinia xanthochymus* HOOK. f.	India
14	A	Passion fruit	*Passiflora edulis* SIMS.	Brazil
15	E	Pangi	*Pangium edule* REINW ex BL	Malay

Species were classified by 'Useful Plants of the World' (ed. Hotta, M. *et al.* Heibonsha Tokyo, 1989).

Native country were judged by 'Fruit trees in south-east Asia' (Iwasa, S. Nourin Tokei Kyoukai, Tokyo, 1974)

Table 2. Characteristics of fruitlets and leaflet of tropical and subtropical fruits collected from Pohnpei Islands of the FSM

Number	Common name	Fruitlets characters									Leaflets characters				
		Type	Diameter		Hight	Weight	Peel colour	Flesh colour	Seeds Number	Embryo colour	Type	Serration	Winginess	Leaf blade	
			Long	Short										Long	Width
			(mm)	(mm)	(mm)	(g)								(mm)	(mm)
1	Water rose apple	Single	26.7	25.0	21.1	5.7	Pink~White	Pink~White	0~ 4	Yellow~Green	Simple	None	None	187.5	64.0
2	Water rose apple	Single	29.3	27.4	26.8	7.8	Pink	Pink~White	0	-	Simple	None	None	139.0	50.5
3	Water rose apple	Single	34.3	32.0	31.3	12.1	Red	Red~White	0~ 5	Yellow~Green	Simple	None	None	134.0	58.0
4	Samarang rose apple	Single	52.5	49.4	41.5	34.7	Pink~White	Pink~White	0	-	Simple	None	None	154.0	71.0
5	Malay apple	Single	58.0	54.1	62.8	92.8	Green~Pink	White	2	Light green	Simple	None	None	209.5	74.5
6	Pitanga	Single	21.9	20.0	18.3	3.9	Red~Green	Orange~Green	2~ 9	Light green	Simple	None	None	46.0	24.5
7	Governor plum	Single	21.1	20.6	20.3	5.3	Yellow~Red	White	0~11	White	Simple	Serration	None	183.0	77.5
8	Bilimbi	Single	17.9	17.6	44.7	9.5	Green~Yellow	White~Yellow	0	-	Compound	None	None	86.5	29.5[x]
9	Carambola	Single	67.7	63.7	103.9	115.5	Green~Yellow	Yellow~Green	4~10	White	Compound	None	None	70.5	32.0[x]
10	Acerora	Single	20.7	19.7	17.4	4.4	Red~Orange	Red~Reange	3~ 4	White	Simple	None	None	36.0	18.5
11	Indian mulberry	Multiple	42.9	41.9	48.5	43.2	Yellowish green	White~Yellow	Many	Brown	Simple	None	None	281.5	164.0
12	Guava	Single	41.3	40.4	47.5	43.2	Yellowish green	Light-orange	Many	White	Simple	None	None	95.5	46.0
13	Egg tree	Compound	68.9	67.7	70.5	111.8	Yellow	Yellow	2~ 3	White	Simple	None	None	240.0	77.0
14	Passion fruit	Single	Immature				-	-	-	-	Simple	Serration	None	135.6	146.7
15	Pangi	Compound	142.0	137.4	217.0	2090.0	Reddish brown	Yellow	20	White	Simple	None	None	146.7	123.0

[x] Determined from single leaflets of the compound leaf.

(Pitanga) and 43.2g (Guava and Indian mulberry). Indian mulberry and Guava had the most numerous number of seeds whereas the pink fleshed Water rose apple, Samarang rose apple and Bilimbi fruits were seedless. Apart from Bilimbi fruit and Carambola which had compound leaf type all the other fruits had simple leaves.

Juice quality analysis data on total soluble solids (Brix) content, sugar constituents, acidity and acids constituents are presented on Table 3. Brix content was highest in Pangi fruits; 16 followed by Egg tree; 9.4, Guava; 7.6 and lowest in Water rose apple; 3.0. Pangi and to a lesser extent Governor plum had a high proportion of their soluble sugars as, sucrose (non reducing sugar) and less glucose and fructose (reducing sugars). The remainder of the fruits showed the opposite result. Mannitol was largely absent in most of fruits apart from traces found in Pangi, Acerola and Indian mulberry. Titratable acidity was highest in Egg tree fruit and Governor plum (581 Meq/L and 435 Meq/L, respectively) and lowest in Pangi fruit (21.1 Meq/L). Total organic acids constituents were highest in Egg tree fruit and lowest in Pangi fruit. In general, citric, L-malic, succinic and oxalic acids were detected in most of the fruits. In fruits of Egg tree, Pitanga, Guava and Water rose apple the most abundant organic acid was citric acid followed by L-malic acid and succinic acid. On the other hand, Governor plum and Indian mulberry contain the highest L-malic acid although Governor plum contains high qunic acid. Pangi is almost acidless, fruits contain low organic acids.

In summary, the 15 samples that were collected from Pohnpei Island were classified into 13 species. Based on characteristics such as sugar and acid balance and amount of flesh, most of the fruits such as Malay apple, Samarang rose apple, Acerora, Guava etc. have a high potential of utilization as food sources. With regards to some fruits such as Pangi although there is a possibility that the seeds may contain some toxic compounds, the flesh has been found to be edible with a sweet taste and low acidity. Within the 13 species determined in this study 11 had a high glucose and fructose content and low sucrose content and other two a high sucrose content and low glucose and fructose content. In this study the possibility that,

Table 3. Sugar and organic acids constituents in juice of tropical and subtropical fruits collected from Pohnpei Islands of the FSM

Number	Common name	Brix	Sugar Constituents (%)					Titratable acidity (Meq/L)	Organic acids constituents (%)							
			Sucrose	Glucose	Fructose	Manitol	Total		Oxalic	Citric	Tartaric	Gluconic	L-Malic	Qunic	Succinic	Total
1	Water rose apple	3.0	0.01	1.02	1.46	tr	2.49	121.7	0.02	0.85	–	–	0.13	–	0.55	1.55
2	Water rose apple	3.3	0.01	0.87	1.63	tr	2.51	146.7	0.02	1.00	–	–	0.11	–	0.53	1.66
3	Water rose apple	4.2	0.01	1.32	1.97	tr	3.29	140.4	0.01	0.80	–	–	0.11	–	0.44	1.36
4	Samarang rose apple	5.0	0.03	1.91	2.47	tr	4.41	80.3	tr	0.25	–	–	0.05	–	0.35	0.65
5	Malay apple	6.4	tr	2.67	3.15	tr	5.82	35.9	tr	0.16	0.14	–	0.12	–	0.18	0.60
6	Pitanga	5.1	tr	1.41	1.95	tr	3.35	197.3	tr	2.05	–	–	0.21	0.12	0.47	2.85
7	Governor plum	7.4	4.03	0.61	0.97	tr	5.62	434.5	tr	0.10	–	–	1.75	1.30	0.10	3.25
8	Bilimbi	3.1	0.16	1.20	1.45	tr	2.81	78.0	0.23	–	–	–	0.10	0.04	0.06	0.43
9	Carambola	3.6	0.20	1.30	1.49	tr	2.98	131.8	0.55	–	0.01	–	–	–	0.15	0.71
10	Acerora	6.6	0.04	1.23	1.28	0.01	2.57	156.0	0.45	–	–	–	0.66	–	0.28	1.39
11	Indian mulberry	5.7	0.61	1.10	1.07	0.12	2.89	62.4	0.03	–	–	0.78	0.35	–	–	1.16
12	Guava	7.6	0.70	1.72	2.46	tr	4.88	140.4	0.02	1.70	–	–	0.40	–	0.22	2.34
13	Egg tree	9.4	0.06	1.84	2.30	tr	4.21	581.1	tr	2.98	–	–	0.28	–	0.03	3.29
14	Passion fruit	Immature														
15	Pangi	16.0	13.80	0.76	0.69	0.02	15.27	21.1	tr	0.07	–	–	0.10	–	–	0.17

fruit quality characteristics such as sugar, acid content could be affected by site of sampling, fruit developmental stage, was found, this area deserves further investigation.

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