Potential Genetic Resources of Some Tropical Fruits in Thailand

Suranant SUBHADRABANDHU*

Abstract

Tropical fruits have been known and consumed by local habitants for many decades. Some tropical fruits have been commercially cultivated and have accounted for a great part of the country's national income. In Thailand, fruit production during the last five years (up to 1990) averaged 4.5 million tons, of which about US$ 250 million worth or about 2.5% of the production was exported.

Although there are many kinds of tropical fruits in Thailand, only about 20 species are commercially cultivated. The cultivated varieties of these tropical fruits have been selected according to the likings of the local growers. Thus the taste of the present leading fruit varieties in Thailand mainly corresponds to the fondness of the tropical Asians. However at present, there are still many indigenous plants which are botanically closely related to these tropical fruit species. If properly utilized, some of these indigenous plants could offer a great potential as genetic resources for the improvement of the existing tropical fruits varieties in Thailand.

Introduction

Although many kinds of fruits can be grown in Thailand, only about 20 species are exploited commercially. The distribution of fruits in the country varies according to the climatic conditions in a particular locality. The central plain of Thailand is predominantly known as a tropical fruit-producing area and fruits such as sapodilla, tropical grape, banana, guava, pumelo, wax-apple, tangelo, mango, papaya, satal, lime are being grown. The trees are commonly seen growing on raised ridges in this area. In the lowland area of the northern provinces such as Chiang Mai, Chiang Rai, Lamphun, many subtropical fruits like longan, lychee, orange as well as some tropical fruits like mango, pumelo are commercially cultivated. However in the highland areas of northern Thailand with high elevation over 1, 000 on above sea level, some temperate fruit trees such as peach, plum, apple, Asian pear, Japanese apricot, persimmon are commercially grown by hilltribe farmers as an alternative to opium poppy previously grown in these areas. Areas along the coastal belts around the Gulf of Thailand are cultivated with pineapple with many canning factories operating in these areas. In the eastern and southern provinces, humid-like tropical fruits such as durian, mangosteen, rambutan, longong and lansat are commonly grown whereas the arid-like tropical fruits such as sweet tamarind, sour tamarind, sugar-apple, cashew nut, papaya and mango are produced in some northeastern provinces.

Fruit production in Thailand is becoming more important in the county economy. At present, about 80-90% of the production is consumed locally, leaving 10-20% for export (Table 1). Although the total production did not increase appreciably in the last five years. (Table 2) there are signs of increase in the planting area for some kinds of tropical exotic fruits with high prospect in foreign market (Tables 1, 3).

There are constraints and problems associated with the fruit industry as a whole. Apart form the need for better orchard management, improved cultivation techniques, high quality and healthy planting

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* Department of Horticulture, Kasetsart University, Bangkok 10900, Thailand

Table 1 Amount and value of some fresh fruits exported from Thailand

Q = quantity in ton; V = value in 1,000 US$.

Fruits	1990		1991		1992		1993	
	Q	V	Q	V	Q	V	Q	V
Durian	7,203	5,024	14,392	10,612	7,978	6,044	15,116	10,964
Lychee	744	740	769	860	563	748	1,477	2,368
Longan	9,205	2,856	14,355	8,444	7,618	6,504	12,811	11,908
Mango	4,205	1,208	5,724	1,496	3,236	1,044	3,947	1,264
Mangosteen	659	504	1,077	628	353	212	1,116	688
Papaya	1,235	344	247	88	89	36	75	60
Pumelo	7,077	2,548	5,916	2,020	7,039	2,664	5,889	2,876
Rambutan	601	232	2,219	572	871	284	1,700	428
Tangerine	682	160	819	224	643	212	601	196

Source: Department of Economic Trade, Ministry of Commerce Thailand.

Table 2 Planted area, harvested area and total production of tropical tree fruits in Thailand

Item \ Year	1986/87	1987/88	1988/89	1989/90	1989/91
Planted area (ha)	824,000	867,200	859,200	870,400	894,400
Harvested area (ha)	616,000	640,000	608,000	595,200	617,600
Total yield (million ton)	3.60	3.75	4.52	5.34	5.55

Source: Fruit Division, Dept. of Agricultunal Extension.

Table 3 Planted area and production of some fruits of economic importance in Thailand

Kinds of fruits	1985/86		1986/87		1987/88		1988/89		1989/90		1990/91	
	Planted area (ha)	Production ($\times 10^3$ ton)	Planted area (ha)	Production ($\times 10^3$ ton)	Planted area (ha)	Production ($\times 10^3$ ton)	Planted area (ha)	Production ($\times 10^3$ ton)	Planted area (ha)	Production ($\times 10^3$ ton)	Planted area (ha)	Production ($\times 10^3$ ton)
Durian	73,370	402	76,139	426	84,500	444	82,927	486	90,340	465	95,367	539
Lychee	7,499	12	8,212	14	7,842	19	9,622	24	9,667	22	12,045	24
Longan	18,2299	43	20,334	20	23,605	59	25,585	57	29,348	106	31,855	87
Mango	166,149	373	171,128	386	183,541	422	185,686	440	196,873	885	112,913	894
Mangosteen	12,399	69	13,494	65	15,009	67	18,503	77	22,218	90	24,150	91
Papaya	12,343	214	11,733	206	20,390	408	19,523	214	19,456	206	29,571	408
Pumelo	12,521	55	12,702	58	15,019	69	14,020	70	14,865	69	14,506	68
Rambutan	67,640	478	70,695	476	71,108	449	70,639	528	72,100	499	69,116	578
Sapodilla	19,579	57	19,187	56	18,778	54	11,724	50	11,289	59	10,929	60
Tangerine	42,756	518	44,805	561	44,877	555	49,730	703	48,392	657	47,295	470

materials, the improvement of existing varieties must not be overlooked. Usually the commercial cultivars of tropical fruits in Thailand were developed by selection of seedlings by local growers. However, many indigenous species also occur and these plants may be useful as genetic resources for plant breeders seeking better cultivars. Being indigenous species, some plants may be used as rootstocks for the existing commercial cultivars for better growth under adverse conditions, as well as improved tolerance to pests and diseases.

Some economic fruits of Thailand

Although there are many kinds of fruits in Thailand, only about 20 of them are grown for commercial purposes. Some of the leading economic fruit crops and some of their related species which may be of genetic value are briefly described in this paper.

1 Durian (*Durio zibethinus* Merr.)

Durian is a famous as well as a disputable fruit, however it is much liked by people of tropical Asia. It is often referred to as the King of Tropical Fruits, even though it gives off a very strong smell. Perhaps for this reason, the fruits are barred from airplanes and most hotels even in the countries where durian is produced. Among the Asian countries, Thailand is probably the major producer of quality, commercial durian which has evolved through a long process of selection (Yaacob and Subhadrabandhu, 1993). The three most popular Thai varieties are Kan Yao, Mon Thong and Chanee. Kan Yao has been considered to be the best due to its creamy richness. The current favorite is Mon Thong which has very small seeds, a heavy flesh, a milder taste and a less overpowering scent. Chanee is considered to be the garden variety and the fruits are well known in Hong Kong and Singapore markets. In the 1990-91 season, the country produced about 540,000 tons of fruits from 95,000 ha (Table 2).

Indigenous *Durio* species of Thailand are found mainly in the southern part of the country. A brief description of some species is given in the following paragraphs.

1. *Durio griffithii* (Mast.). Bakh. Locally known in South Thailand as "durian tupai" or "Turian nok". It is a small to medium tree seldom reaching more than 4 feet girth. The fruit is scarlet in color with an ellipsoid shape and about 3 inches long. The seeds are triangular, glossy black with a small basal orange aril.

2. *Durio lowianus* Scort ex King. Locally known as "durian daun". It is a big tree reaching a height of 150 feet and 9 feet girth with steep short buttresses. Young fruit is green and turns yellow when it ripens, it is globose, ovoid or ellipsoid in shape, 10×8 inches in size. The seeds are ovoid with a dark yellow aril.

3. *Durio graveolens* Becc. Locally known as "durian merah". This is also a big tree reaching a height of 150 feet and 10 feet girth with steep and long 9-10 feet buttresses. The fruit is globose shape with an orange-yellow color and reaches 4 inches in diameter. The seeds are ellipsoid and enclosed in a dark red reputedly edible aril.

4. *Durio malaccensis* Planch. ex. Mast. Locally known as "durian batang" or "turian don". It is a medium-size tree reaching a height of 80 feet and 4 feet girth, the bole is slightly fluted or buttresses. The fruit is red and globular in shape, 6×6 inches in size, with broadly conical spines 0.4 inch long. The seeds are brown, the aril is thin and ivory-white.

5. *Durio macrophyllus* (King) Ridney. Locally known as "durian daun besar". This is a small to medium tree with small buttresses. The fruit is round, 3.5×2.3 inches in size, narrowing to the base, blue-green in color. The fruit is set with sharp pyramidal dense spines 0.4 inch long. The seeds are smooth, pale yellow cream and completely covered with a thin white aril.

6. *Durio oxyleyanus* Griff. Locally known as "durian beluda". This is a big tree more than 120 feet tall and 10 feet in girth, the bole is buttressed and up to 10 feet tall. The fruit is globular, 6-8 inches across with 4 valves. It is grayish green. The spines are 1.6 inch long, stiff, broadly pyramid and slightly curved. The seeds are glossy red-brown and completely enclosed in a fleshy dark yellow very sweet aril.

7. *Drio carinatus* Mast. Locally known as "durian pah". This is a medium tree 100 feet tall and over 6 feet in girth, usually without buttresses. The fruit is pale orange-yellow, ovoid to ellipsoid, 5×4 inches in size splitting into 5 segments. It is covered with 0.6 inch stiff pyramidal spines. The seeds are smooth,

glossy black to very dark brown and covered with a bright red aril except for yellowish basal scars.

2 **Mango** (*Mangifera indica* Linn.)

In Thailand mango is considered to be one of the most important economic fruits like pineapple and durian. In 1990 the area under mango cultivation was about 113,000 hectares with a production of about 894,000 tons (DOAE, 1991). The principal production regions are located in Northeast and North Thailand with 42% and 28% of the total mango cultivation area, respectively. The central, eastern and western regions have substantial plantings, each accounting for about 10% of the total planted area. In South Thailand there are no commercially important production areas.

Thailand is unique in that mango is consumed in significant quantities as green fruit in addition to the consumption of fruits at the ripe stage. Green mangoes are of equal importance as ripe fruits in terms of production in Thailand. Different cultivars are usually utilized as green and ripened fruits with Khiew Sawoey being the dominant green cultivar whilst Okrong and Nam Dok Mai are the dominant ripened cultivars. The harvesting season for mango in Thailand lasts from the middle of March to the middle of May. Flowering starts early in the southern region which is near the equator and occurs late in the northern part of the country. Fruits in the northern region are harvested about one and a half month later than those in the rest of the country. Mangoes are usually grown together with other fruits or other cash crops. The farms are usually small, ranging from 0.5 to 2.5 hectares of mixed orchards on previously rice-growing lands.

Besides Thailand, collections of *Mangifera indica* cultivar are developed in other countries where mango is grown commercially. Germplasm collections of other *Mangifera species* are promoted in Indonesia, Malaysia, the Philippines, Thailand and India. All wild *Mangifera* species are potentially useful for breeding purposes.

The following lists include those *Mangifera species* that wildly grow in the natural forest in Thailand.

1. *Mangifera foetida* Lour. or horse mango. It is locally known as "ma mut or malamut" in southern Thailand. The tree grows up to 30-35 m, the bole is straight without buttresses. The edible fruits, vary in size and shape. They are obliquely ovoid-oblong or almost globose drupe, 9-14 cm×7-12 cm in size. The smooth peel is dirty dark olive-green or yellowish-green, with brown lenticels. The flesh is pale orange or yellow, with a high proportion of fiber in the flesh. The edible part is juicy with a strong smell and taste of turpentine at its full extent. The stone is plump, about 6 cm×5 cm×3 cm in size, and coarsely fibrous with monoembryonic seed (Bompard, 1991).

2. *Mangifera* odorata Griffith. or commonly known as "kuwini". It is locally known in southern Thailand (Narathiwat Province) as "kinning". This is a medium-sized tree 10-15 m high. The crown is globose or broadly ovoid, the bole is straight with grey bark containing an irritant sap. The fruit is 10-13 cm ×6-9 in size and obliquely ellipsoid-oblong with hardly flattened drupe. The fruit is green to yellowish-green, sparingly spotted with dark brown lenticels with a rather thick rind. The orange yellow flesh is edible, firm, fibrous with sourish-sweet juice. The flesh has a pungent smell and taste of turpentine. The stones, 8-10 cm×4.5-5 cm×2.5-3 cm in size, are covered with rather soft fibers, frequently containing polymbryonic seeds (Bompard, 1991).

3. *Mangifera quadrifida* Jack. It is locally known as "mamuang-khan". The tree can reach a height of 30 m with a trunk diameter of 100 cm. The fruit is about 2.5×3.5 cm×1.5-2.5 cm in size, it has a broadly ellipsoid to obovoid shape. The skin is yellow to rosy-red and turns blackish when the fruit is fully ripe. The edible flesh is seweet, pale orange-yellow, juicy and fibrous.

4. *Mangifera cochinchinensis* Pierre. This species is near extinction. It is locally known as "mamuang-kilen". The tree is about 35 m, tall. The fruit is a suboblongoid drupe 3 cm×1.5 cm in size.
In the natural habitat, the tree flowers from January-May and fruiting occurs from March-May (Mukherjee, 1985).

5. *Mangifera Lagenifera* Griffith. This is also a very rare species. It is locally known as "mamuang-pom". The tree can grow up to a height of 30 m, or more. The fruit is a pyriform drupe, about 11 cm×6 cm in size. The skin is pale green to brownish. The flesh is edible but it is sour and stringy with a dirty white to pinkish color. Fruiting time occurs from March to May (Bompard and Kostermans, 1985).

6. *Mangifera caesia* Jack. It is locally known as "bin-yaa or lam-yaa". The species is found in the south-

ern provinces near Malaysia. It is a large tree, often attaining a height of over 30 m and the bole is 50-80 cm or more in diameter. The bole is columnar without buttresses, the crown is dome-shaped with massive branches. The bark is grayish-brown, superficially fissured, and contains an irritant sap. The fruit is edible and shows an abovate-oblong drupe, necked at the base. The fruit size is about 12-15 cm×6-7 cm, with a yellowish or pale brownish skin which is very thin (about 1 mm thick). The flesh is whitish, soft and juicy, fibrous, with a peculiar sourish taste and strong smell at maturity. The seeds are ellipsoid-lanceolate in shape, about 7 cm×3.5 cm, and not flattened. The endocarp is not woody and contains matted coarse fibers with a monoembryonic character (Kostermans, 1965).

Besides the above-mentioned *Mangifera* species, other native, but lesser known species have been recorded, as follows.

7. *Mangifera longipes* Griff., locally known as "mamuang-kalaeng".
8. *Mangifera sylvatica* Roxb., locally known as "mamuang-kee-tai".
9. *Mangifera duperreana* Pierre var. siamensis Craib, locally known as "mamuang-kee-ya".
10. *Mangifera gracilipes* Hook. f, locally known as "mamuang-chun".
11. *Mangifera camptosperma* Pierre, locally known as "mamuang-barb".
12. *Mangifera caloneura* Kurz, locally known as "mamung-ka-lon".
13. *Mangifera longipetiolata* King, locally known as "mamuang-pah".
14. *Mangifera pentandra* Hook. f., localy known as "mamuang-pah".

These *Mangifera* species are indigenous to Thailand and they are found in various parts of the country. Although, at present almost none of them have been studied or brought into cultivation, they could be good genetic resources for mango breeding programs.

3 **Rambutan** (*Nephelium lappaceum* L.)

Rambutan is one of the common and economically important fruits of Thailand. The tree can be grown in most parts of the country. Statistics for 1990, give an area of 72,100 ha of rambutan in Thaland with a crop output of 450, 625 tons, of which only 601 tons were exported as fresh fruits (DOAE, 1991). Commercial scale production occurs in the eastern and southern provinces which account for 99.5% of the total area devoted to rambutan.

In Thailand, the three most widely grown cultivars of rambutan are "Rongrien", "Srichompoo" and "Bangyeekhan". These cultivars probably originated from selection of seedlings introduced from Malaysia. Other less popular cultivars include "Seetong" "Nam-tarn-gruad" and "Je-mong". As rambutan trees are usually cross-pollinated, under natural conditions there is considerable genetic variability among the seeding progenies (Whitehead, 1959).

Apart from *Nephelium lappaceum* L. or the cultivated rambutan, other indigenous species of *Nephelium* occur in Thailand. Some of these species have a high potential to become cultivated as well as used as, breeding materials for the existing rambutan cultivars. They are briefly described as follows.

1. *Nephelium hypoleucums* Kurz., locally known as "kho laen". In the natural habitat, the tree grows up to 30 m, in height, the trunk is about 1.4 m, in diameter with buttresses up to 1.5 m. The edible furit is ellipsoid, red in color about 2.3 cm×1.5−2.25 cm in size shows dense warts about 1.5 mm, high.
2. *Nephelium ramboutan-ake* (Labill.) Leenh., synonym *N. mutabile* Blume. commonly known as pulasan or "ngoh-knonsan" which means "short-wart rambutan" in Thai. The tree is very similar to rambutan. The fruit is edible and is not very different from rambutan. It is oblong, measuring about 5-6 cm by 3.7 cm. The skin is dark red when the fruit is ripe and is covered with short, thick and fleshy warts. The flesh is translucent, usually whitish and quite sweet. There are several races differing in the quality of fruit (Chin and Yong, 1982).

Conclusion

Almost all the tropical fruit cultivars in Thailand were derived from the wind species. Many of them are heterozygous and due to the traditional propagation by seeds, high quality trees have been continuously selected by growers and developed to new varietal names. The collection and preservation of the existing wild species as genetic resources had not been seriously promoted in Thailand and also in other

Southeast Asian countries. It is regretable that many indigenous species are faced with extinct in presently.

Appendix I : Plants in the durian group

Scientific name	Common name	Thai name
Durio zibethinus Merr.	Durian	Turian
Durio griffithii Barh.	–	Turian nok
Durio Lawianus Scort ex. King	–	Turian nok
Durio graveolens Becc.	–	Turian merah
Durio malaccensis Planch. ex. Mast	–	Turian don
Durio macrophyllus Ridney	–	Turian daun
Durio oxyleyanus Griff	–	Turian beluda
Durio carinatus Mast	–	Turian pah
Durio mansoni Bakh	–	Turian tuen

Appendix II : Plants in the mango group

Scientific name	Common name	Thai name
Mangifera indica L.	Mango	Ma-muang
M. foetida Lour	Horse mango	Ma-mut
M. odorata Griffith.	Kuwini	Kin-ning
M. quadrifida Jack	–	Ma-muang khan
M. cochinchinensis Pierre	–	Ma-muang kilen
M. lagenifera Griffitah	–	Ma-muang pom
M. caesia Jack	–	Lam-yaa
M. longipes Griff.	–	Ma-muang kalaeng
M. sylvatica Roxb	–	Ma-muang kee-tai
M. duperreana Pierre	–	Ma-muang kee-ya
M. gracilipes Hook. f.	–	Ma-muang chum
M. camptosperma Pierre	–	Ma-muang barb
M. caloneura Kuzz.	–	Ma-muang ka-lon
M. longipetiolata King	–	Ma-muang pah
M. pentendra Hook. f.	–	Ma-muang pah
M. flava Evrard.	–	Ma-muang pap

Appendix III : Plants in the mangosteen Croup

Scientific name	Common name	Thai name
Garinia mangostana Linn	Mangosteen	Mung-koot
G. costana Hemsl.	–	Mung koot pah
G. gracilis Pierre	–	Mug pap
G. rostrata (Hassk.) Miq.	–	Mong lai
G. hanburyi Hook. f.	Cambodge tree	Rong
G. acuminata Planch. Triang	–	Rong tong
G. atroviridis Griff.	–	Som kaeg
G. xanthochymus Hook. f	Egg tree	Ma da Luang
G. dulcis	–	Ma-phut

Appendix Ⅳ : Plants in the rambutan group

Scientific name	Common name	Thai name
Nephelim lappaceum L.	Rambutan	Ngoh
N. hypoleucum Kuzz.	—	Kho-aen
N. rambutan-ake (Labill.)	Leenh	
syn. *N. mutabile* Blume.	Pulasan	Ngoh-knonsan
N. malaiense Blume.	—	Ngoh-direk

References

1) Boampard, J. M. (1991): Mangifera foetida Lour. *In*: Verheij, E. W. M. and Coronel, R. E. (Eds.). PROSEA: Plant Resources of South-East Asia 2. Edible fruits and nuts. p. 209-211 Pudoc, Wageningen.
2) Bompard, J. M. and Kostermans, A. J. G. H. (1985): Wild Mangifera species in Kalimantan, Indonesia. *In*: Mehra, K. L. and Sastrapradja, S. (Eds.). Proceedings of the International Symposium on South-East Asian Plant Genetic Resources, 20-24 August 1985, Jakarta. Lembaga Bilogi Nasional LIPI, Bogor. pp 172. 174.
3) Chin, H. F. and Yong, H. S. (1982): Malaysian Fruits in Colour. Tropical Press. Sdn. Bhd. Kuala Lumpur.
4) DOAE (1989): Fruit production statistics. Dept. of Agricultural Extension, Thailand. (In Thai).
5) DOAE (1991): Fruit production statistics. Dept. of Agricultural Extension, Thailand. (In Thai).
6) Kostermans, A. J. G. H.(1965): New and critical Malaysian plants VII *Mangifera caesia* Jack. Reinwardtia, 7, 19-20.
7) Mukherjee, S. K. (1985): Systematic and ecogeographic studies on crop genepools 1 *Mangifera* L. IBPGR, Rome. 86 pp.
8) Whitehead, D. C. (1959): The rambutan: a description of the characteristics and potentinal of the more important varieties. Malayan Agric. J., 42, 53-75.
9) Yaacob, O. and Subhadrabandhu S. (1993): Production of Economic Fruits in South-East Asia. Oxford University Press, Malaysia.

Discussion

Ganashan, P. (Sri Lanka): Do you impose any restriction for the exchange of germplasm of fruit crops with other countries? Do you prohibit the removal of fruit species from Thailand from breeding purposes?

Answer: We have lifted such restrictions and the exchange of planting materials of fruit species for research purposes can be negotiated through government-government agreements.