

## **Diversity and use of traditional fruit species in selected home gardens or fruit orchards in Malaysia**

(Kepelbagaian dan kegunaan spesies buah-buahan tradisi di halaman rumah atau di dusun di Malaysia)

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Key words: diversity, fruits, home gardens, ethnobotany, on-farm conservation

### **Abstract**

The distribution and use of traditional fruit tree species were surveyed in four home gardens or orchards in four different sites in the country. Such data would provide important information required for initiating on-farm conservation efforts. Home gardens or orchards in Kampung Lingkungan, Sabah possessed the highest fruit species diversity followed by that in Kampung Changkul, Sarawak, Kampung Pintas, Sabah and Kampung Hulu Cheka, Jerantut, Pahang, Peninsular Malaysia. The fruit tree species provide food nutrition and food security but more importantly secure household income. The knowledge on the use of fruit tree species for medicines, healthcare and handicrafts is known among very few old folks and is vanishing without being passed on to the younger generations. The land use conversion also leads to a significant loss of fruit tree diversity.

### **Introduction**

Fruit tree species are usually cultivated in home gardens and also in orchards. A home garden is made up of a small area of land surrounding the house whereas a fruit orchard consists of a larger acreage of land usually situated some distance away from home. Home gardens and the fruit orchards do not only consist of fruit trees, but also possess a range of other crop species such as vegetables, root crops, spices and herbs. The diversity of the fruit species in the home gardens or in the fruit orchards is not only an important source of nutrition, but also probably more importantly secure household income and thus leads to the improvement of their livelihoods (Hodel and Gessler 1999). In addition, the diversity of the fruit

species in the home gardens or orchards is known to contribute substantially towards the sustainability of the ecosystem.

In Vietnam, the home gardens in the southern part of the country contain high numbers of different species and have very complex of composition within the crops (Hodel and Gessler 1999). The availability of the diverse fruit species in the home gardens or orchards can constitute the *in situ* conservation complementary to the *ex situ* fruit field genebanks maintained by governmental institutions. Besides, local communities are usually very knowledgeable about the indigenous plants in their collections or gardens and their wealth of knowledge is being lost due to modernization and urbanization.

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The knowledge, relationship and the use of plants by the farmers form an important asset that need to be conserved. The objectives of this study therefore, were to determine the diversity of fruit species maintained in the home gardens or orchards and to gather and document the information on the status of their importance as well as the indigenous knowledge on the use of the species. It is hoped that the data gathered would provide information useful for the *in situ* or on-farm conservation initiative.

## Materials and methods

### Study sites

Four home gardens or orchards from three districts, Jerantut (Pahang), Bandar Sri Aman (Sarawak) and Beaufort (Sabah) were chosen based on the high density of fruits in the area identified from the baseline data of fruit species diversity available in the home gardens and orchards gathered earlier throughout the country (Anon. 2003).

### Diversity and ethnobotanical studies

Ethnobotanical information and the diversity of the traditional fruit tree species in the selected home gardens or orchards were obtained by interviewing the owners of the orchards or home gardens and the head of the community or the head of the village using Participatory Rural Appraisal (PRA) method (Raziah et al. 2004). Field walks around the home gardens or orchards were made to identify the fruit tree species. The occurrences of the fruit tree species, their local names, common names or native names, uses as well as their importance according to farmer's perception were documented. The farming system and the ecosystem of the home garden or orchard were also observed and documented. In each village about 15–20 villagers consisting of men and women were interviewed. The diversity, indigenous knowledge and the status of the fruit species identified by the owner of the home garden or orchard were verified by these villagers. In addition, some

herbarium specimens were also collected and deposited at MARDI herbarium.

## Results and discussion

### Description of the study sites

**Kampung Tengah, Hulu Cheka, Jerantut, Pahang** The fruit orchards at Kampung Tengah, Hulu Cheka, which were developed by the Malay farmers, belonged to the state cooperative fruit orchard. Each farmer possessed about 2–4 ha of land, given by the state government to plant dokong (*Lansium domesticum*) as a main crop in an estate form. Most of the farmers involved in this project had cleared the forest trees and replanted with dokong as a monocrop. However, one farmer still maintained the wild fruit tree species that were originally growing in the area as part of his orchard. The orchards area in general was quite undulating, and was situated close to the jungle fringe of the Titiwangsa mountain range. The rainfall pattern was good whereby maximum rainfall occurred in April and October. The fruit seasons were in August to September (main season) and in January (off-season).

### Rumah Kallang Changkul,

**Bandar Sri Aman, Sarawak** Rumah Kallang Changkul is an Iban long house situated at Engkelili, Bandar Sri Aman. The ethnic group staying at the Rumah Kallang Changkul long house was the Iban who owned a communal land. Major crops grown in this area were pepper, rubber, hill and wet paddy, fruits and vegetables. Traditional fruit species maintained over generations were found growing in the secondary forests situated along the Batang Ai river. A small area of land however, was planted with *mata kucing* (*Dimocarpus longan* subsp. *malesianus*), locally known as *Isau* under the supervision of the Sarawak Department of Agriculture. The rainfall pattern was good and well distributed with no distinct dry season.

**Kampung Lingkungan, Beaufort,**

**Sabah** At Kampung Lingkungan in the district of Beaufort, the fruit tree species were intercropped under rubber agroforestry system. It was lowland area planted with oil palm trees. The major fruits were pineapple and *Citrus* growing under oil palm as an anchor crop. The traditional fruits were found in the secondary forest along the Lingkungan river banks and also in the home gardens. The ethnic group in this area was the Kedayan, and the soil was of Dalit series.

**Kampung Pintas, Beaufort, Sabah** The main crops grown were oil palm, rubber, paddy, fruits and vegetables. The traditional fruits were found growing in the secondary forest. The community in this area consisted of the Bisayah ethnic group. The land in Kampung Pintas is marginal, of Tuaran series and drainage system had to be improved to avoid flash floods from the river. Most of the traditional fruit species were removed when the villagers converted their land into oil palm plantations. The rainfall pattern was good with two peaks in the months of May and November.

**Diversity and distribution of traditional fruit species**

A total of 85 traditional fruit species from 25 families and 41 genera were identified from the four home gardens or orchards studied (Table 1). Among these, seven species were found in three home gardens or orchards, while 12 species occurred in two home gardens or orchards. *Baccaurea motleyana* (Rambai) could be found in all the four home gardens. Three genera that possessed the highest species diversity were *Mangifera* (10 species), *Baccaurea* (9 species) and *Artocarpus* (10 species). Seven species which occurred both in West and East Malaysia were *Averrhoa carambola*, *Garcinia atroviridis*, *Nephelium ramboutan-ake*, *Mangifera odorata*, *Mangifera caesia*, *Parkia speciosa* and *Pangium edule*.

However some species were locality specific. Species such as *Artocarpus sericicarpus*, *A. dadah*, *A. altilis*, *A. anisophyllus*, *A. sarawakensis*, *Dacryodes rostrata f. cuspidata*, *Garcinia parvifolia*, *Durio testudinarum* and *Dimocarpus longan* subsp. *malesianus* (Isau) were known to be found in Sabah and Sarawak only, while *Durio lowianus* has been recorded to be found only in Peninsular Malaysia (Salma 1996). Kulip (1996) who surveyed the indigenous plants at Tambunan, Sabah showed that out of 168 plants collected, 29 species were fruit trees. Similarly, in Vietnam, Trinh et al. (2003) reported that small farms and home gardens are rich in fruit tree diversity.

Kampung Lingkungan in Sabah had the highest diversity of fruit species, followed by Rumah Kallang Changkul in Sarawak and Kampung Pintas in Sabah and the least number of species diversity was found in Kampung Tengah in Pahang (Figure 1 and Appendices 1–4). The diversity of fruit species occurring in the four home gardens or orchards surveyed, seemed to be very much influenced by the farming system practised and the ecological features of the area. In addition, socio-economics of the households and labour available in the area

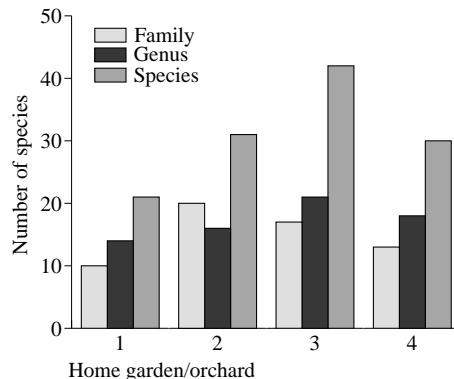


Figure 1. Number of family, genus and species of traditional fruits recorded at (1) Kg. Hulu Cheka, Jerantut, Pahang, (2) Rumah Kallang Changkul, Bandar Sri Aman, Sarawak (3) Kg. Lingkungan, Beaufort, Sabah and (4) Kg. Pintas, Beaufort, Sabah

Table 1. Fruit species in the four home gardens or orchards

Family	Scientific name	Common name
Anacardiaceae	<i>Mangifera caesia</i> **	Binjai/Belunu
	<i>Mangifera foetida</i>	Bacang
	<i>Mangifera griffithii</i>	Raba
	<i>Mangifera odorata</i> **	Kuini/Wani
	<i>Mangifera pajang</i> *	Bambangan/Embang
	<i>Mangifera pentandra</i>	Pauh/Asam pauh
	<i>Mangifera quadrifida</i>	Ranca-ranca
	<i>Mangifera torquenda</i>	Kemantan
	<i>Mangifera</i> sp.	Mempelam
	<i>Mangifera</i> sp.	Kokong
	<i>Bouea macrophylla</i>	Kundang
	<i>Dracontomelum dao</i> **	Sengkuang/Seronsob
	<i>Pentaspodon motleyi</i>	Pelajau
Annonaceae	<i>Annona muricata</i>	Durian belanda
	<i>Rollinia speciosa</i>	Rollinia
Apocynaceae	<i>Willughbeia firma</i>	Serapit/Bungok
	<i>Willughbeia</i> sp.	Kubal/Ucung
Bombacaceae	<i>Durio dulcis</i>	Durian merah
	<i>Durio lowianus</i>	Durian cempa, durian sangka
	<i>Durio testudinarum</i>	Durian kura-kura
Bursaceae	<i>Canarium megalanthum</i>	Kedondong
	<i>Canarium odontophyllum</i>	Dabai
	<i>Canarium</i> sp.	Kedondong
	<i>Dacryodes rostata f. cuspidata</i> **	Kembayau
Combretaceae	<i>Terminalia catappa</i>	Ketapang
Dipterocarpaceae	<i>Dipterocarpus</i> sp.	Engkabang
Elaeocarpaceae	<i>Elaeocarpus lanceolatus</i>	Mengkinang
	<i>Elaeocarpus sphaeroblastus</i>	Pensit
Euphorbiaceae	<i>Baccaurea angulata</i>	Tampoi belimbing
	<i>Baccaurea lanceolata</i>	Limpaung
	<i>Baccaurea macrocarpa</i> **	Tampoi/tampoi puteh
	<i>Baccaurea motleyana</i> +	Rambai
	<i>Baccaurea polynuera</i>	Jentik-jentik
	<i>Baccaurea pyriformis</i>	Tampoi tungau
	<i>Baccaurea racemosa</i> **	Mata kunau/Kekunau
	<i>Baccaurea reticulata</i>	Taban
	<i>Baccaurea</i> sp.	Entaban
	<i>Elateriospermum tapos</i>	Perah
Flacourtiaceae	<i>Phyllanthus acidus</i>	Cermai
	Unidentified sp.	Kejijak
	<i>Flacourtia rukam</i> *	Rukam manis
	<i>Pangium edule</i> **	Kepayang
	<i>Castanopsis inermis</i>	Berangan
Guttiferae	<i>Garcinia atroviridis</i> *	Asam gelugur
	<i>Garcinia nitida</i>	Kandis
	<i>Garcinia parvifolia</i> *	Kundong/Aroi-aroi
	<i>Garcinia prainiana</i>	Cerapu
	<i>Garcinia</i> sp.	Kandis

(cont).

Table 1. (cont.)

Family	Scientific name	Common name
Lauraceae	<i>Litsea graciae</i> **	Engkala/Pengalaban
Leguminosae	<i>Dialium indum</i>	Keranji
	<i>Parkia speciosa</i> *	Petai
	<i>Pithecellobium jiringa</i>	Jering
Melastomaceae	<i>Plethiandra</i> sp.	Jambu atar
Meliaceae	<i>Lansium domesticum</i>	Langsat/dokong
	<i>Sandoricum indicum</i>	Sentul kapas
	<i>Sandoricum koetjape</i> **	Sentul
Moraceae	<i>Artocarpus altilis</i> **	Sukun
	<i>Artocarpus anisophyllus</i>	Terap ikal
	<i>Artocarpus camansi</i>	Kulor
	<i>Artocarpus dadah</i>	Beruni
	<i>Artocarpus elasticus</i>	Tabut
	<i>Artocarpus integer</i> var. <i>sylvestris</i>	Bangkong
	<i>Artocarpus odoratissimus</i> *	Terap/Tarap
	<i>Artocarpus sarawakensis</i>	Pingan
	<i>Artocarpus sericarpus</i> *	Pedalai/Terap bulu
	<i>Artocarpus</i> sp.	Lumok
Myrtaceae	<i>Ficus</i> sp.	Ara
	<i>Syzygium aqueum</i> **	Jambu air
	<i>Syzygium malaccenses</i>	Jambu bol
Oxalidaceae	<i>Syzygium</i> sp.	Jambu akar
	<i>Averrhoa bilimbi</i> *	Belimbing buluh
Palmae	<i>Caryota urens</i>	Ijuk
	<i>Daemonorops periacantha</i>	Rotan
Polygalaceae	<i>Xanthophyllum amoenum</i> **	Langir
Rubiaceae	<i>Morinda citrifolia</i>	Mengkudu
	Unidentified sp.	Sesagir
Rutaceae	<i>Citrus aurantifolia</i>	Limau nipis
	<i>Citrus grandis</i>	Limau bali
	<i>Citrus microcarpa</i>	Limau kasturi
Sapindaceae	<i>Nephelium cuspidatum</i> var. <i>Robustum</i>	Bayung
	<i>Nephelium ramboutan-ake</i> *	Pulasan/Maritam/Pulasan hitam
	<i>Dimocarpus longan</i> subsp. <i>malesianus</i>	Isau, mata kucing
	<i>Lepisanthes alata</i>	Engkelili
	<i>Pometia pinnata</i>	Kasai
Zingerberaceae	<i>Hornstedtia scyphifera</i>	Senggang

\*Species present in three home gardens or orchards

\*\*Species present in two home gardens or orchards

+Species present in all home gardens or orchards

also indirectly contribute to the species diversity (Raziah et al. 2004).

The normal practice of clearing the land for agricultural development as observed in Kampung Tengah, Pahang is one of the main threats that contributes to the loss of genetic resources. Due to lack of

knowledge on the importance of the under utilized fruit species in the forest, all the 74 farmers (except for one) who were involved in the development of about 122 ha fruit estate had cut down all other trees making way for the planting of new fruits viz. dokong. The only farmer who recognized

the potential and the value of the under utilized fruit tree species continued to maintain the fruit species, thus indirectly helping to conserve them. Therefore, awareness on the importance of the under utilized fruit species is essential not only among the farmers but also to the extension officers as well for conservation.

*Perah* (*Elateriospermum tapos*) is famous and can be found in abundance in this district. The cotyledons cooked into dishes tasted very delicious. Although many trees had been cut down for the development of fruit estate, but quite a number of trees still grow wild in the jungle nearby. During flowering season, *Perah* trees can be recognized by their red flush which can be seen from far.

In Sarawak and Sabah, the fruit trees are found growing in the secondary jungle and are subjected to different natural and human selection pressures. For example, since the orchards are very near the rivers, sometimes they get flooded during the monsoon season. The fruit tree species in the orchards are passed from generation to generation of farmers who hardly manage the ecosystem. Most of the farmers however, do not have the initiative to grow new fruit tree species in their orchards since these fruit trees only provide side income to them. The only traditional fruit species cultivated was *Isau*, which was planted at Rumah Kallang Changkul, under the supervision of Sarawak Department of Agriculture.

### Key species

The key species at different home gardens or orchards were identified based on their economic importance. The farmers at the different home gardens or orchards determined the key species that could contribute to their income. At Kampung Tengah, Pahang, six species (*G. atroviridis*, *M. odorata*, *E. tapos*, *P. speciosa*, *B. macrocarpa* and *B. reticulate*) were listed as very important fruits in this village that could contribute good income as they fetch quite high price. In Sabah, *M. pajang*, *N.*

*ramboutan-ake* and *A. odotratissimus* were important traditional fruits at Kg. Lingkungan. Two similar fruit species *M. pajang* and *N. ramboutan-ake* were also important at Kg. Pintas. In addition, *P. speciosa* (*Petai*) was another important traditional fruit species in this village.

### Use of traditional fruit species

The traditional fruit tree species in the home gardens or orchards were found to have multiple uses (*Table 2* and *Appendices 1–4*). They were either eaten fresh, used in cooking, for medicine and also used in making handicrafts. Based on the total number of the traditional fruit species available in the four home gardens or orchards, about 79% of the traditional fruit species recorded were consumed fresh, while 30% of the species could be cooked into dishes. Four fruit species needed to be dried before being used as flavouring food or cooked into dishes. Meanwhile, the fruits of *G. atroviridis* (*Asam gelugur*) and *G. parvifolia* (*Kundong* or *Aroi-aroi*) were normally dried and used to give a sour taste to food. *Averrhoa belimbi* (*Belimbing buluh*) fruits can be pickled or dried and then

Table 2. Multiple uses of traditional fruit tree species gathered from four home gardens or orchards

Uses of traditional fruit trees	Number of species
Fresh fruits	68
Cooked as dishes	26
Dried fruit	4
Flavour	4
Pickled	7
Fruit juice	3
Seed boiled or cooked into dishes	7
Oil from seed	2
Leaf as salad or cook into dishes	4
Colouring	1
Wine from flower	1
Medicine	6
Healthcare/Shampoo	1
Handicraft	2
Hairs made into rope	1
Trunk made into ceiling	1

cooked into dishes. In addition, the immature fruits of *M. foetida* and *M. odorata* could be used to make salad.

In some fruit species, the seeds were also eaten. Seeds of *P. edule* (*Kepayang*) and *E. tapos* (*Perah*) were noted to be very poisonous, but they could be made edible after careful treatment and if used in special dishes (*Plates 1–2*). For example, seeds of *E. tapos* were washed under running water for overnight, while seeds of *P. edule* were boiled for one hour, followed by washing in running water overnight. Processed *Kepayang* seeds were sold in the Tamu market in Sarawak. Oil extracted from *Engkabang* (*Dipterocarpus* sp.) and *Kepayang* seeds could be used in cooking.

Besides the fruits, the leaves from four traditional fruit species were also eaten either as salad or used in cooking. The leaves of *G. atroviridis*, *G. prainiana* and *G. parvifolia* could be eaten as salad and used in cooking to give a sour flavour while leaves from *Morinda citrifolia* were boiled first before eating.

Only five fruit species were found to have medicinal values. The juice from boiled *G. atroviridis* fruits was used for afterbirth treatment. Water from boiled leaf of *A. bilimbi* leaves was said to reduce high blood pressure while the water from the boiled bark of *P. speciosa* was used to treat diabetes. The flowers of *Kenatol* were used for eye treatment. The knowledge on the use of fruit trees as medicines was commonly known among the elderly people. However, this knowledge was vanishing without being passed on to the younger generation. This was due to the wide use of modern medicines to cure illness and as such, the value of traditional fruit trees as medicines was not much being practised or recognized.

The multiple uses of these fruit trees also need to be documented. For example *Senggang* (*Hornstedtia scyphifera*), which is from the Zingerberaceae family was a very useful plant. The stem and the leaves were made into handicrafts material such as mattress, hat and *tuak* sieve (*Plate 3*).



Plate 1. *Pangium edule* (*Kepayang*) fruit



Plate 2. *Elateriospermum tapos* (*Perah*) fruit and seeds

Similarly, *Ijuk* (*Caryota urens*) a palm, was found to be another important fruit tree to the farmers. The nectar from the flowers was made into a traditional alcoholic drink known as *tuak* specially served to visitors or consumed during festivals. The cotyledon from the seed was processed and mixed in a fruit cocktail. The hair from the trunk was usually made into ropes. The trunk was cut into thin pieces and used to decorate ceilings of houses.

Orange flesh of *Sesagir* fruit was traditionally used as food colouring especially in making yellow rice (*Plate 4*). The fruits of *Xanthophyllum amoenum* (*Langir*) was used as shampoo, but nowadays this is not being widely used.



Plate 3. Multiple use of *Hornstedtia scyphifera* (Senggang) plant



Plate 4. *Sesagir* fruit

### Conclusion

The diversity of fruit tree species in the home gardens or orchards is high and they contribute not only to the nutrition but also to supplement the income of the farmers. The diverse fruit species in the home gardens or orchards therefore can serve as *in situ* or on-farm conservation and can complement the *ex situ* conservation by government and other public institutions. Land use conversion results in a significant loss of fruit species diversity. Awareness on the importance and the benefits of conserving the diversity of the fruit species need to be emphasized to the farmers and the extension workers. The vast knowledge of the traditional uses of fruit trees provides useful information for their utilization which needs to be documented and used for conservation and utilization of this valuable natural resource.

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## Abstrak

Taburan dan kegunaan spesies pokok buah-buahan tradisi telah dikaji selidik di empat buah halaman rumah ataupun dusun di negara ini. Data yang dikumpul mengenai taburan dan kegunaan spesies buah-buahan yang ditanam di halaman rumah dan dusun buah-buahan merupakan maklumat penting dalam inisiatif pemuliharaan di halaman rumah atau di dusun. Halaman rumah atau dusun di Kampung Lingkungan, Sabah didapati mengandungi kepelbagaian spesies buah-buahan yang tertinggi berbanding dengan yang terdapat di Kampung Changkul, Sarawak, Kampung Pintas, Sabah dan Kampung Hulu Cheka, Jerantut, Pahang, Semenanjung Malaysia. Spesies buah-buahan menjadi sumber makanan dan pemakanan dan juga dapat menyumbang kepada jaminan makanan kepada petani. Tetapi yang lebih penting ialah spesies buah-buahan ini juga merupakan sumber pendapatan kepada petani. Maklumat kegunaan spesies buah-buahan sebagai ubat-ubatan, bahan kesihatan dan kraf tangan cuma diketahui oleh beberapa orang daripada generasi tua dan ilmu ini semakin hilang daripada generasi muda. Pertukaran penggunaan tanah merupakan salah satu penyebab kepupusan kepelbagaian spesies buah-buahan.

Appendix 1. Fruit species and their uses from home garden or orchard in Hulu Cheka, Jerantut, Pahang

Common name	Scientific name	Parts of plant used	Medicinal use
Asam gelugur	<i>Garcinia atroviridis</i>	Leaves used as vegetable, salad or flavouring Dried fruit used as flavouring in dishes	Juice from boiled fruit for afterbirth treatment
Bacang	<i>Mangifera foetida</i>	Fresh fruit; unripe fruit used as salad or cooked as dishes	—
Bangkong	<i>Artocarpus integer</i> var. <i>sylvestris</i>	Boiled cotyledon Cotyledon used in dishes	—
Belimbing buluh	<i>Averrhoa bilimbi</i>	Fresh fruit used in dishes; pickled; dried	Leaves used for fever, high blood pressure, asthma. Fruit used for high blood pressure
Berangan	<i>Castanopsis inermis</i>	Fried cotyledon; cotyledon made into candy	—
Cerapu	<i>Garcinia prainiana</i>	Fresh fruit; young fruit used in dishes	—
Durian cempa, durian sangka	<i>Durio lowianus</i>	Fresh fruit	—
Jentik-jentik	<i>Baccaurea polynuera</i>	Fresh fruit	—
Kepayang	<i>Pangium edule</i>	Boiled cotyledon; cotyledon cooked as vegetable; made into oil	—
Kuini	<i>Mangifera odorata</i>	Fresh fruit; young fruit cooked into dishes or used as salad; fresh juice	—
Kundang	<i>Bouea macrophylla</i>	Fresh fruit; pickled	—
Mengkinang	<i>Eleoarpus lanceolatus</i>	Fresh fruit	—
Perah	<i>Elateriospermum tapos</i>	Boiled cotyledon; cotyledon made into dishes	—
Petai	<i>Parkia speciosa</i>	Fruit or cotyledon used as vegetable or cooked as dishes	Bark or fruit boiled for high blood pressure and diabetes
Pulasan hutan	<i>Nephelium ramboutan-ake</i>	Fresh fruit	—
Rukam manis	<i>Flacourtia jangomas</i>	Fruit	—

(cont.)

Appendix 1. (*cont.*)

Common name	Scientific name	Parts of plant used	Medicinal use
Sengkuang	<i>Dracontomelum dao</i>	Fruit	–
Taban	<i>Baccaurea reticulata</i>	Fruit	–
Tampoi	<i>Baccaurea macrocarpa</i>	Fruit	–
Tampoi tungau	<i>Baccaurea pyriformis</i>	Fruit	–
Kejjjak	Unidentified sp.	Fruit	–

## Appendix 2. Fruit species and their uses from home garden or orchard at Rumah Kallang Changkul, Bandar Sri Aman, Sarawak

Common name	Scientific name	Parts of plant used	Medicinal use
Ara	<i>Ficus</i> sp.	Fruit; dried fruit	–
Bambangan, Embang	<i>Mangifera pajang</i>	Fresh fruit; young fruit used in dishes	–
Dabai	<i>Canarium odontopyllum</i>	Fruit soaked in warm water; used as dishes	–
Engkala	<i>Litsea graciae</i>	Fruit soaked in warm water	–
Engkabang	<i>Dipterocarpus</i> sp.	Fruit cooked as dishes; seed made into oil	–
Engkelili	<i>Lepisanthes alata</i>	Fresh fruit	–
Entaban	<i>Baccaurea</i> sp.	Fresh fruit	–
Ijuk	<i>Caryota urens</i>	Flower nectar made into wine Cotyledon used in fruit cocktail Hairs from trunks made into ropes Trunk used as ceiling	–
Isau	<i>Dimocarpus longan</i> subsp. <i>malesianus</i>	Fresh fruit	–
Jambu akar	<i>Syzygium</i> sp.	Fruit	–
Jambu atar	<i>Plethiandra</i> sp.	Fruit	–

*(cont.)*

## Appendix 2. (cont.)

Common name	Scientific name	Parts of plant used	Medicinal use
Kubal/Ucung	<i>Willughbeia</i> sp.	Fruit	–
Kembayau	<i>Dacryodes rostrata</i> <i>f. cuspidata</i>	Fruit soaked in warm water	–
Kasai	<i>Pometia pinnata</i>	Fruit	–
Kundong	<i>Gracinia parvifolia</i>	Dried fruit used in dishes Leaf used as vegetable	–
Keranji	<i>Dialium indum</i>	Fruit	–
Kemantan	<i>Mangifera torquenda</i>	Fruit; cooked as dishes; pickled	–
Lumok	<i>Artocarpus</i> sp.	Fruit; seed boiled or fried	–
Langir	<i>Xanthophyllum amoenum</i>	Fruit	–
Pedalai	<i>Artocarpus sericicarpus</i>	Fruit; young fruit cooked as dishes, seed boiled	Skin dried, ground and used as shampoo
Pauh/asam pauh	<i>Mangifera pentandra</i>	Fresh fruit; young fruit cooked as dishes or pickled	–
Pelajau	<i>Pentaspodon motleyi</i>	Seed cooked as dishes	–
Petai	<i>Parkia speciosa</i>	Seed cooked as dishes	–
Pingan	<i>Artocarpus sarawakensis</i>	Parts of plant used	–
Pensit	<i>Elaeocarpus</i> <i>sphaeroblastus</i>	Fresh fruit Fruit	–
Rambai	<i>Baccaurea motleyana</i>	Fruit	Leaves used for afterbirth
Raba	<i>Mangifera griffithii</i>	Fruit	–
Senggang	<i>Hornstedtia scyphifera</i>	Fruit	Leaf and stem used in handicraft
Terap	<i>Artocarpus odoratissimus</i>	Fruit; seed boiled or made into crackers	–
Tabut	<i>Artocarpus elasticus</i>	Fruit	–

Appendix 3. Fruit species and their uses from home garden or orchard at Kampong Lingkungan, Beaufort, Sabah

Common name	Scientific name	Parts of plant used	Medicinal use
Aroi-aroi	<i>Garcinia parvifolia</i>	Fruit	–
Asam gelugur	<i>Garcinia atroviridis</i>	Dried fruit used in dishes Young leaf used in dishes or as salad	–
Bambangan	<i>Mangifera pajang</i>	Fruit; young fruit can make into dishes or used as salad	–
Belimbing buluh	<i>Averrhoa bilimbi</i>	Fruit; fresh and dried fruit used in dishes	Leaf and fruit used for high blood pressure
Belunu/binjai	<i>Mangifera caesia</i>	Fruit; pickled	–
Bayung	<i>Nephelium cuspidatum</i> var. <i>robustum</i>	Fruit	–
Durian merah	<i>Durio dulcis</i>	Fruit	–
Durian kura-kura	<i>Durio testudinarium</i>	Fruit	–
Jambu air	<i>Syzygium aqueum</i>	Fruit	–
Jambo bol	<i>Syzygium malaccenses</i>	Fruit	–
Kandis	<i>Garcinia nitida</i>	Dried fruit used to flavour dishes	–
Kedondong	<i>Canarium megalanthum</i>	Fruit	–
Kembayau	<i>Dacryodes rostata</i> f. <i>cuspidata</i>	Fruit	–
Kepayang	<i>Pangium edule</i>	Seed cooked into dishes	–
Ketapang	<i>Terminalia catappa</i>	Leaf used to wrap food	–
Kulor	<i>Artocarpus camansi</i>	Fruit; boiled seed	–
Kuini	<i>Mangifera odorata</i>	Fruit; young fruit used in dishes	–
Langir	<i>Xanthophyllum amoenum</i>	Pericarp of fruit used as shampoo	–
Langsat	<i>Lansium domesticum</i>	Fruit	–
Limpaung	<i>Baccaurea lanceolata</i>	Fruit used in dishes	–

(cont.)

Appendix 3. (cont.)

Common name	Scientific name	Parts of plant used	Medicinal use
Limau bali	<i>Citrus grandis</i>	Fruit	–
Limau kasturi	<i>Citrus microcarpa</i>	Fruit; juice	Fruit used for afterbirth treatment
Limau nipis	<i>Citrus aurantifolia</i>	Fruit	Fruit used for afterbirth treatment
Mengkudu	<i>Morinda citrifolia</i>	Leaf used as vegetable	Fruit used as traditional medicine
Mata kucing	<i>Dimocarpus longan</i> subsp. <i>malesianus</i>	Fruit	–
Mempelam	<i>Mangifera</i> sp.	Fruit; young fruit used as dishes	–
Mata kunau/Kekunau	<i>Baccaurea racemosa</i>	Fruit	–
Pulasan hitam/ maritam	<i>Nephelium</i> <i>ramboutan-ake</i>	Fruit	–
Pengalaban	<i>Litsea gracieae</i>	Fruit	–
Rukam manis	<i>Flacourtia rukam</i>	Fruit	–
Rambai	<i>Baccaurea motleyana</i>	Fruit	–
Rotan	<i>Daenonorops</i> <i>periacantha</i>	–	Handicraft
Sukun	<i>Artocarpus altilis</i>	Fruit	–
Sentul kapas	<i>Sandoricum indicum</i>	Fruit	–
Serapit/ Bungok	<i>Willughbeia firma</i>	Fruit	–
Sentul	<i>Sandoricum koetjape</i>	Fruit	–
Tarap	<i>Artocarpus odoratissimus</i>	Fruit; seed boiled	–
Tampoi belimbing	<i>Baccaurea angulata</i>	Fruit	–
Tampoi putih	<i>Baccaurea macrocarpa</i>	Fruit	–

(cont.)

## Appendix 3. (cont.)

Common name	Scientific name	Parts of plant used	Medicinal use
Terap ikal	<i>Artocarpus anisophyllus</i>	Fruit	–
Terap bulu	<i>Artocarpus sericicarpus</i>	Fruit	–
Kenatol	Unidentified sp.	Flower	Eye treatment

## Appendix 4. Fruit species and their uses from home garden or orchard at Kampong Pintas, Beaufort, Sabah

Common name	Scientific name	Parts of plant used	Medicinal use
Asam gelugur	<i>Garcinia atroviridis</i>	Fruit used in dishes; dried fruit used in flavouring dishes; young leaves used as vegetables or salad	–
Aroi-aroi	<i>Garcinia parvifolia</i>	Fruit used in dishes; dried fruit used in flavouring dishes; young leaves used as vegetables or salad	–
Bambangan	<i>Mangifera pajang</i>	Fruit; young fruit used in dishes	–
Belunu/binjai	<i>Mangifera caesia</i>	Fruit; pickled	–
Belimbing buluh	<i>Averrhoa bilimbi</i>	Fruit	High blood pressure
Beruni	<i>Artocarpus dadah</i>	Fruit	–
Cermai	<i>Phyllanthus acidus</i>	Fruit; pickled	Leaves used as medicine
Durian belanda	<i>Annona muricata</i>	Fruit	–
Jering	<i>Pithecellobium jiringa</i>	Fruit	–
Jambu air	<i>Syzygium aqueum</i>	Fruit	–
		Fruit cooked as dishes	
Kandis	<i>Garcinia</i> sp.	Fruit	–

(cont.)

## Appendix 4. (cont.)

Common name	Scientific name	Parts of plant used	Medicinal use
Kedondong	<i>Canarium</i> sp.	Fruit	–
Kokong	<i>Mangifera</i> sp.	Fruit	–
Kekunau	<i>Baccaurea racemosa</i>	Fruit	–
Meritam/pulasan hitam	<i>Nephelium ramboutan-ake</i>	Fruit	–
Pengalaban/engkala	<i>Litsea graciae</i>	Seed cooked as dishes	–
Pelajau	<i>Pentaspodon motleyi</i>	Seed used as vegetable or cooked as dishes	–
Petai	<i>Parkia speciosa</i>	Fruit	Diabetes
Ranca-ranca	<i>Mangifera quadrifida</i>	Fruit	–
Rollinia	<i>Rollinia speciosa</i>	Fruit	–
Rambai	<i>Baccaurea motleyana</i>	Fruit	–
Rukam	<i>Flacourtia rukam</i>	Fruit	–
Seronob/sengkuang	<i>Dracontomelum dao</i>	Fruit	–
Sukun	<i>Artocarpus altilis</i>	Fruit	–
Sentul	<i>Sandoricum koetjape</i>	Fruit	–
Tarap	<i>Artocarpus odoratissimus</i>	Fruit	–
Terap bulu	<i>Artocarpus sericicarpus</i>	Fruit	–
Wani/kuini	<i>Mangifera odorata</i>	Fruit	–
Sesagir	Unidentified sp.	Fruit	Yellow food colouring