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Malaysian Species of Plants with Edible Fruits or Seeds and Their Valuation

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This article compiles species of fruit plants in Malaysia that can be used as a reference in environmental impact assessment and conservation of fruit plants in Malaysia. A total of 520 species of plants that produce edible fruits or seeds in Malaysia were retrieved from the literature. These plants are broadly grouped into trees (355 species) and non-trees (165 species). Their economic and cultivation status along with the habit of fruit plant species were determined through literature searches and verified through semi-structured interviews with orchard and home garden owners and fruit market inspection throughout the country. In terms of economic status, the tree species were distributed into three categories: major (70 species), medium (93 species), and minor (192 species). Non-tree species of fruit plants in Malaysia were grouped into herbs (43 species), shrubs (40 species), woody climbers (40 species), herbaceous climbers (36 species), liana or shrub (3 species), aquatic herbs (2 species), and bush or climber (1 species). The overall total number of exclusively wild, wild or planted, and exclusively planted species were 229 (44.0%), 129 (24.8%), and 162 (31.15%), respectively. This study provides a framework for the valuation of species of plants that produce edible fruits or seeds in Malaysia.

KEYWORDS *valuation, livelihood, compensation, economic status, planting status, conservation*

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INTRODUCTION

Fruit plants are important to the livelihood, culture, and religion of people around the world. These plants are not only important as a source of food and income, but they help to bind inter-family and family ties and provide a sense of belonging when fruit trees are jointly owned through inheritance. A study by Peluso (1996) on a Dayak community in Kalimantan, Malaysia revealed that long-lived fruit trees, such as durian, were jointly cultivated by several generations of the planters' descendents. These trees possess sentimental value to the owners because of emotional attachments to them. Certain fruits are used as offerings in religious rituals (Cheu, 1996) and funerals. Still, other fruits are used as gifts.

Fruit trees are among the items for which people are compensated when they are affected by land acquisition and resettlement programs. However, the basis for compensation for fruit plants is still unclear in Malaysia. Such information is often not accessible to the public or academics. Some principles on compensation for losses during acquisition and resettlement have been discussed by international agencies. Asian Development Bank (1998) emphasized replacement as the basis for compensation for all the losses during the process of resettlement. This was criticized by the Rural Development Institute (2007). One of the reasons is because the term replacement and its derivatives are poorly defined. Another reason is the neglect for the cost of an appropriate replacement for the expropriated asset where a functioning market is lacking. Hence, the Rural Development Institute (2007) suggested that compensation should be based on replacement cost, which consists of market value (the prevailing standard in the world of state expropriations or other forms of mandatory acquisitions), premium (reparation for the involuntary nature of the taking), transaction costs (all reasonable administrative charges, taxes, title or registration fees, and other legal costs associated with replacing the lost assets), interest (only when substantial time passed between the time of the determination of compensation and the time affected people receive the compensation), and damages (caused by the physical occupation of the land by a government through expropriation deserve consideration and corresponding compensation). The formula is as follows.

$$\begin{aligned} \text{Replacement cost} &= \text{Market value} + \text{Premium} + \text{Transaction cost} \\ &+ \text{Interest} + \text{Damages.} \end{aligned}$$

For the compensation of trees, the Rural Development Institute (2007) wrote "Where sufficiently developed markets exist, the market value of trees of a similar age and use should be used in valuation. Where markets do not exist, surrogate values must be determined. For timber trees, the compensation should equal the value of the lumber resulting from the tree. For fruit trees, the compensation should equal the cumulative future value of

TABLE 1 Standard Rates of Compensation for Standing Crops and Structures (cited by Asian Development Bank, 2007)

		Annual		CNY400/mu regardless of variety of the crop	
Crops	Perennial	Timber trees	Less than 3 cm in diameter	1.5/tree	
			3–5 cm	3/tree	
			6–10 cm	5/tree	
			11–15 cm	8/tree	
			16–20 cm	10/tree	
			21 cm or above	15/tree	
		Fruit trees	Mature tree with fruits	50/tree	
			Trees that just bear fruits	30/tree	
			Trees that do not bear fruits	10/tree	
			Young trees	1/tree	
		Structures	Bamboo		0.6/kg
			Brick house		88/m ²
			Clay brick house		45/m ²
Grain storage			0/piece		
Pigsty			40/piece		
	Drying ground		40/piece		

the fruit crop for its productive life along with any timber value. If replacement trees are provided, compensation should also include the value of the harvests lost until the replacement trees come into full production.” The compensation standard for trees (regardless of age) for most provinces in China was discussed by the Rural Development Institute (2007) and is summarized in Table 1. It is believed that a similar scheme has been practiced in Malaysia. In Malaysia, however, compensation rates vary between species and plant age groups. For example, the compensation rate estimates per fruit tree (in Malaysian ringgit) of *Durio zibethinus* Murr. in the age groups 0 to 1 year, more than 1 to 6 years, more than 6 to 20 years, more than 20 to 50 years, and more than 50 years are 68, 143, 525, 300, and 143, respectively.

There are several books that describe Malaysian fruits, but their content is too exhaustive to accurately represent the diversity of fruit-producing plant species in Malaysia. Examples are books by Chin and Yong (1980) and Aman (1999). Chin and Yong documented 68 species of Malaysian fruits that they grouped into those that produce common fruits, rare fruits, ornamental fruits, wild fruits, nuts, and highland fruits. Aman (1999) documented 108 species of Malaysian fruits that she grouped into those that produce common fruits, rare fruits, and fruits from Sabah and Sarawak. Certain Malaysian fruits have also been categorized as underutilized. Generally, these are fruits familiar to very few people and grown on a small scale or found in the wild. Although economically less important, they are thought to have potential for commercial exploitation. There is still no definitive species list of underutilized Malaysian

TABLE 2 Species of Plants That Produce Underutilized Fruits in Malaysia

No.	Species
1	<i>Averrhoa bilimbi</i> L.
2	<i>Baccaurea macrocarpa</i> (Miq.) Muell. Arg.
3	<i>Baccaurea polyneura</i> Hk. F
4	<i>Bouea oppositifolia</i> (Roxb.) Meis.
5	<i>Cynometra cauliflora</i> L.
6	<i>Dimorcarpus longan</i> ssp. <i>malesianus</i> Leenh. var. <i>malesianus</i>
7	<i>Durio lowianus</i> Scott. ex King
8	<i>Durio kutejensis</i> (Hassk). Becc.
9	<i>Garcinia prainiana</i> King
10	<i>Garcinia costata</i> Hemsl. ex King
11	<i>Mangifera foetida</i> Lour.
12	<i>Mangifera odorata</i> Griff.
13	<i>Nephelium ramboutan-ake</i> (Labill.) Leenh.
14	<i>Phyllanthus emblica</i> L.
15	<i>Salacca conferta</i> Griff.
16	<i>Sandoricum koetjape</i> (Burm f.) Merr.
17	<i>Syzygium jambos</i> (L.) Alst.
18	<i>Syzygium malaccense</i> (L.) Merr. & Perry
19	<i>Zizyphus mauritiana</i> Lamk

fruit plants. The following examples (Table 2) are gleaned from various literature sources, such as Khoo et al. (2008) and Ikram et al. (2009).

More comprehensive information on the species of fruit plants of Malaysia is needed to assess their importance, especially to native people. A survey by Alias et al. (2010) indicated that the native people in Peninsular Malaysia are generally unhappy with the compensation rates for losses of their trees (including fruit trees) during land acquisition. These can be used in environmental costs and benefits analysis, which is part of the environmental impact assessment of developments in Malaysia. Such information is also needed to devise a compensation approach that is comprehensive and conforms to standards proposed by international development agencies. The present article is a culmination of previous documentation on species of plants that produce edible fruits or seeds in Malaysia and are supplemented with surveys on fruit markets, orchards, and home gardens of native people in the country. Implications and strategies for the conservation of species of plants that produce edible fruits or seeds will also be discussed.

METHODOLOGY

A thorough literature search was carried out for species of plants that produce edible fruit or seeds in Malaysia. Exotic fruit species recently introduced into the country, such as temperate fruits, were however excluded from this study. The economic and cultivation status and the habit of each species was obtained from the literature and verified through visits to local fruit markets, and semi-structured interviews with more than 100 owners of home gardens

and orchards throughout the country. The primary literature referenced for this study was Burkill (1935), Chin and Yong (1980), and Aman (1999).

RESULTS

Information for 520 species of plants that produce edible fruits or seeds in Malaysia was obtained. These species are grouped into trees and non-trees species. Tree species comprise 68.3% (355 species) of the total number of species that produce edible fruits or seeds in Malaysia and are shown in Table 3. Non-trees species comprise 31.7% (165 species) of the total number of species of plants that produce edible fruits or seeds in Malaysia and are shown in Table 4. The tree species are distributed into three categories: major (70 species), medium (93 species), and minor (192 species). In the first category, the number of species that are exclusively wild, wild or planted, and exclusively planted are 5 (7.1%), 24 (34.3%), and 41 (58.6%), respectively. All these species produce fruits that, apart from self-consumption, have economic demand and therefore are mostly sold for income by native people in Malaysia. In the second category, the number of species that are exclusively wild, wild or planted, and exclusively planted are 27 (29.0%), 37 (39.8%), and 29 (31.2%), respectively. All of the species of the second category are produce fruits that are typically used for self-consumption, and are usually traded, but on a small scale. In the third category, the number of species that are exclusively wild, wild or planted, and exclusively planted are 124 (64.6%), 42 (21.9%), and 26 (13.3%), respectively. All the species in the third category produce fruits that are not usually traded, but are harvested or collected for self-consumption.

Based on their growth habit, the non-tree fruit producing plant species were grouped into seven categories. These are herbs (43 species), shrubs (40 species), woody climbers (40 species), herbaceous climbers (36 species), liana or shrub (3 species), aquatic herbs (2 species), and bush or climber (1 species). The number of herbs that are exclusively wild, wild or planted, and exclusively planted are 14 (32.6%), 10 (23.6%), and 19 (44.2%), respectively. The number of species of shrubs that are exclusively wild, wild or planted, and exclusively planted are 19 (47.5%), 8 (20%), and 13 (32.5%), respectively. The number of species of woody climbers that are exclusively wild, wild or planted, and exclusively planted are 33 (82.5%), 3 (7.5%), and 4 (10%), respectively. The number of species of herbaceous climbers that are exclusively wild, wild or planted, and exclusively planted are 3 (8.3%), 3 (8.3%), and 30 (83.3%), respectively. All three species of lianas/shrubs are wild. The two species of aquatic herbs are wild or planted. The only species of liana is wild. The overall total number of exclusively wild, wild or planted, and exclusively planted species are 229 (44.0%), 129 (24.8%), and 162 (31.15%), respectively.

TABLE 3 Species List of Trees That Produce Edible Fruits or Seeds in Malaysia (in Alphabetical Order)

Bil	Species	Common names	Economic status ^z	Cultivation status
1	<i>Adenanthera pavonina</i> L.	Saga, saga hutan	Minor	Wild, planted
2	<i>Aegle marmelos</i> (L.) Corr.	Bilak, bael, bel	Medium	Planted
3	<i>Aglaia oligophylla</i> Miq.	Belangkas hutan	Minor	Wild
4	<i>Aglaia tomentosa</i> Tesym. & Binn.	Medang berbulu, redan	Minor	Wild
5	<i>Alangium salviifolium</i> Wange.	Ankota	Minor	Planted
6	<i>Aleurites moluccana</i> (L.) Willd.	Buah keras, candlenut	Major	Planted
7	<i>Anacardium occidentale</i> L.	Gajus, cashew	Major	Planted
8	<i>Anacolosia frutescens</i> (Bl.) Bl.	Belian landak, galo nut	Medium	Planted
9	<i>Annona muricata</i> L.	Durian belanda, soursop	Major	Planted
10	<i>Annona reticulata</i> L.	Nona kapri	Major	Planted
11	<i>Annona squamosa</i> L.	Nona serikaya, sweetsop	Major	Planted
12	<i>Antbocephallus cadamba</i> Miq.	Kelempayan	Minor	Wild, planted
13	<i>Antidesma bunias</i> (L.) Spr.	Buni, Chinese laurel	Minor	Wild, planted
14	<i>Antidesma ghaesembilla</i> Gaert.	Gunchiak	Minor	Wild, planted
15	<i>Antidesma montanum</i> Bl.	Gunchiak gajah	Minor	Wild
16	<i>Antidesma tomentosum</i> Bl.	Mata pelandok	Minor	Wild
17	<i>Aporosa prainiana</i> King	Beberas hutan, rambai kera	Minor	Wild
18	<i>Archidendron jiringa</i> (Jack) Niel.	Jering	Major	Wild, planted
19	<i>Archidendron microcarpum</i> (Benth.) Niel.	Kerdas	Major	Wild, planted
20	<i>Ardisia lurida</i> Bl.	Mata ketam gajah	Minor	Wild
21	<i>Arenga pinnata</i> Merr.	Enau, kabong, sugar palm	Major	Wild, planted
22	<i>Artocarpus altilis</i> (Parkin.) Fosb. var. <i>Silvestris</i>	Kelor, seeded breadfruit	Medium	Wild, planted
23	<i>Artocarpus altilis</i> (Parkin.) Fosb.	Sukun, seedless breadfruit	Major	Planted
24	<i>Artocarpus anisophyllus</i> Miq.	Bintawa, entawa	Medium	Wild, planted
25	<i>Artocarpus elasticus</i> Reinw. ex Bl.	Terap, terkalong	Minor	Wild
26	<i>Artocarpus fulvicortex</i> Jarr.	Orange-barked tampang	Medium	Wild, planted
27	<i>Artocarpus gomezianus</i> Wall. ex Tre.	Tampang	Medium	Wild, planted
28	<i>Artocarpus heterophyllus</i> Lam.	Nangka, jack	Major	Planted
29	<i>Artocarpus integer</i> (Thunb.) Merr.	Cempedak	Major	Planted
30	<i>Artocarpus integer</i> var. <i>silvestris</i> Cor.	Bangkong	Major	Wild
31	<i>Artocarpus kemando</i> Miq.	Cempedak air, pudau	Minor	Wild
32	<i>Artocarpus lanceifolius</i> Roxb.	Keledang, nangka pipit	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
33	<i>Artocarpus lakoocha</i> Roxb.	Tampang ambang, keledang berok	Minor	Wild
34	<i>Artocarpus nitidus</i> subsp. <i>borneensis</i> (Merr.) Jarr.	Shiny tampang	Medium	Wild
35	<i>Artocarpus nitidus</i> subsp. <i>griffithii</i> (King) Jarr.	Tampang	Minor	Wild
36	<i>Artocarpus nitidus</i> subsp. <i>humilis</i> (Becc.) Jarr.	Selangking	Medium	Wild, planted
37	<i>Artocarpus odoratissimus</i> Blan.	Terap, pangan	Major	Wild, planted
38	<i>Artocarpus rigidus</i> Bl.	Tempunik, pala munsuh	Medium	Wild, planted
39	<i>Artocarpus sarawakensis</i> Jarr.	Pingan	Medium	Wild, planted
40	<i>Artocarpus sericicarpus</i> Jarr.	Terap bulu	Medium	Wild, planted
41	<i>Arytera littoralis</i> Bl.	Kelayu hitam, tampang kecil	Minor	Wild
42	<i>Averrhoa bilimbi</i> L.	Belimbing asam, bilimbi	Major	Planted
43	<i>Averrhoa carambola</i> L.	Belimbing, starfruit	Major	Planted
44	<i>Baccaurea angulata</i> Merr.	Belimbing merah	Medium	Wild
45	<i>Baccaurea bracteata</i> Muell. Arg.	Rambai hutan, tampoi bunga, monkey's tampoi	Medium	Wild
46	<i>Baccaurea brevipes</i> Hk.f.	Rambai ayam, setambun lilin, blue rambai	Minor	Wild
47	<i>Baccaurea dulcis</i> Muell. Arg.	Cupa, tupa	Medium	Planted
48	<i>Baccaurea griffithii</i> Hk.f.	Rambai hutan, tampoi butang	Minor	Wild
49	<i>Baccaurea hookeri</i> Gage	Jelintih, peris	Medium	Wild, planted
50	<i>Baccaurea kunstleri</i> King ex Gage.	Rambai hutan	Minor	Wild
51	<i>Baccaurea lanceolata</i> (Miq.) Muell. Arg.	Rambai hutan, mempaung, green rambai	Medium	Wild, planted
52	<i>Baccaurea macrocarpa</i> (Miq.) Muell. Arg.	Tampoi, greater tampoi	Major	Wild, planted
53	<i>Baccaurea macrophylla</i> (Muell. Arg.) Muell. Arg.	Tampoi bunga	Medium	Wild
54	<i>Baccaurea motleyana</i> (Muell. Arg.) Muell. Arg.	Rambai	Major	Wild, planted
55	<i>Baccaurea parviflora</i> (Muell. Arg.) Muell. Arg.	Setambun	Minor	Wild
56	<i>Baccaurea polyneura</i> Hk. f.	Jentik-jentik	Minor	Wild
57	<i>Baccaurea pyriformis</i> Gage.	Tampoi burung, fig tampoi	Minor	Wild
58	<i>Baccaurea racemosa</i> (Reinw. ex Bl.) Muell. Arg.	Kapundung, jinteh merah	Minor	Wild
59	<i>Baccaurea ramiflora</i> Lour.	Pupor, tampoi, burmese grape	Minor	Wild
60	<i>Baccaurea reticulata</i> Hk.f.	Tampoi bunga, lesser tampoi	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
61	<i>Baccaurea velutina</i> Ridl.	Tampoi tungau	Minor	Wild
62	<i>Barringtonia asiatica</i> Kurtz.	Putat laut	Minor	Wild
63	<i>Barringtonia racemosa</i> Roxb.	Putat kampung	Medium	Wild, planted
64	<i>Barringtonia scortechinii</i> King	Putat gajah	Minor	Wild
65	<i>Bertholletia excelsa</i> Humb. and Bonpl.	Kacang brazil	Medium	Planted
66	<i>Blumeodendron tokbrai</i> (Bl.) Smith.	Medang lempong	Minor	Wild
67	<i>Borassus flabellifer</i> L.	Lontar, palmyra	Major	Wild, planted
68	<i>Bouea macrophylla</i> Griff.	Kundang, setar, gandaria	Major	Wild, planted
69	<i>Bouea oppositifolia</i> (Roxb.) Meis.	Rumenia, plum mango	Medium	Wild, planted
70	<i>Buchanania sessilifolia</i> Bl.	Otak udang	Minor	Wild
71	<i>Calophyllum inophyllum</i> L.	Penaga laut, penaga air	Minor	Wild, planted
72	<i>Calophyllum pulcherrimum</i> Wall.	Bittanggur batu, bittanggur besar	Minor	Wild, planted
73	<i>Camellia sinensis</i> (L.) Kuntze	Teh, tea	Major	Planted
74	<i>Canarium denticulatum</i> Bl.	Kenari, sajeng	Medium	Wild, planted
75	<i>Canarium indicum</i> L.	Kenari	Medium	Planted
76	<i>Canarium littorale</i> Bl.	Kedondong pasir	Minor	Wild
77	<i>Canarium odontophyllum</i> Miq.	Dabai	Medium	Wild, planted
78	<i>Canarium patentinervium</i> Miq.	Kedondong, kaju kedapak	Minor	Wild
79	<i>Canarium pilosum</i> Benn.	Kedondong kerut	Minor	Wild
80	<i>Careya arborea</i> Roxb.	Putat kedang, tummy wood	Minor	Wild
81	<i>Cassia fistula</i> L.	Bereksa, golden shower	Minor	Planted
82	<i>Cassia grandis</i> L.f.	Kasia merah, horse cassia	Minor	Wild, planted
83	<i>Castanopsis acuminatissima</i> (Bl.) DC.	Meranak	Minor	Wild
84	<i>Castanopsis costata</i> (Bl.) DC.	Berangan bukit	Medium	Wild
85	<i>Castanopsis foxworthyi</i> Schott.	Berangan	Medium	Wild
86	<i>Castanopsis inermis</i> (Lindl. ex Wall.) Benth	Berangan	Medium	Wild
87	<i>Castanopsis javanica</i> (Bl.) DC.	Berangan duri	Medium	Wild
88	<i>Castanopsis lucida</i> (Nees.) Soep.	Berangan papan	Medium	Wild
89	<i>Castanopsis malacensis</i> Gamb.	Berangan gajah	Medium	Wild
90	<i>Castanopsis megacarpa</i> Gamb.	Berangan gajah, greater malayan chestnut	Minor	Wild
91	<i>Castanopsis rhamnifolia</i> (Miq.) DC.	Berangan babi	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
92	<i>Castanopsis tungurrut</i> (Bl.) DC.	Tunggurut	Minor	Wild
93	<i>Castanopsis wallichii</i> King ex Hk.f.	Berangan	Medium	Wild
94	<i>Ceiba pentandra</i> Gaertn.	Kekabu, kapok	Minor	Wild
95	<i>Cheilosa malayana</i> (Hk.f.) Cor. ex A. Shaw	Tampoi, tempuni	Medium	Wild
96	<i>Chrysophyllum cainito</i> L.	Sauh durian, star apple	Minor	Planted
97	<i>Chrysophyllum oliviforme</i> L.	Buah susu, star apple, satin leaf	Minor	Planted
98	<i>Chrysophyllum roxburghii</i> Don	Pepulut, star apple	Minor	Planted
99	<i>Cicca acida</i> Merr.	Cermai	Medium	Planted
100	<i>Citrofortunella microcarpa</i> (Bunge) Wijn.	Limau kesturi, limau chuit, calamondin	Major	Planted
101	<i>Citrus aurantifolia</i> Swin.	Limau nipis, lime	Major	Planted
102	<i>Citrus hystrix</i> DC.	Limau purut, kafir lime	Major	Planted
103	<i>Citrus limon</i> (L.) Burm.f.	Lemon, limau	Major	Planted
104	<i>Citrus maxima</i> (Burm.) Merr.	Limau bali, pomelo	Major	Planted
105	<i>Citrus medica</i> L.	Limau susu	Major	Planted
106	<i>Citrus paradisi</i> Macf.	Grapefruit	Minor	Planted
107	<i>Citrus reticulata</i> Blan.	Limau langkat	Major	Planted
108	<i>Citrus sinensis</i> (L.) Osb.	Limau manis	Major	Planted
109	<i>Clausena lansium</i> Ske.	Wampi	Minor	Wild, planted
110	<i>Cocos nucifera</i> L.	Kelapa, coconut	Major	Planted
111	<i>Coelostegia griffithii</i> Benth.	Durian kura	Minor	Wild
112	<i>Coffea arabica</i> L.	Kopi arab, arabian coffee	Major	Planted
113	<i>Coffea canephora</i> Pierre ex Froehn.	Kopi gajah, robusta coffee	Medium	Planted
114	<i>Corypha utan</i> Lamk	Lontar hutan, ibus	Minor	Wild, planted
115	<i>Crescentia cujete</i> L.	Labu kayu, calabash	Minor	Planted
116	<i>Cycas rumphii</i> Miq.	Paku laut	Minor	Wild, planted
117	<i>Cycas siamensis</i> Miq.	Paku gajah	Minor	Wild, planted
118	<i>Cynometra cauliflora</i> L.	Nam nam	Medium	Planted
119	<i>Cyrbomandra betacea</i> (Cav.) Sendt.	Tree tomato	Major	Planted
120	<i>Dacryodes rostrata</i> (Bl.) H.J. Lam	Kembayau, kedondong kerut	Medium	Wild, planted
121	<i>Decaspermum fruticosum</i> J.R. & G. Forster	Kelentit kering	Minor	Wild
122	<i>Dialium cochinchinense</i> Pierre	KerANJI kertas kecil	Medium	Wild, planted
123	<i>Dialium indum</i> L.	KerANJI kertas besar	Medium	Wild, planted
124	<i>Dialium platysepalum</i> Baker	KerANJI kuning	Minor	Wild, planted
125	<i>Dillenia indica</i> L.	Simpoh kasar	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
126	<i>Dillenia meliosmaefolia</i> Hk.f. & Thom.	Simpoh bukit	Minor	Wild
127	<i>Dimorcarpus longan</i> ssp. <i>malesianus</i> Leenh. var. <i>malesianus</i>	Mata kucing	Major	Wild, planted
128	<i>Diospyros blancoi</i> DC	Buah mentega	Minor	Planted
129	<i>Diospyros diepenborstii</i> Miq.	Arang	Minor	Wild
130	<i>Diospyros digyna</i> Jacq.	Black persimmon	Minor	Planted
131	<i>Diospyros basseltii</i> Zoll.	Merangat	Minor	Wild
132	<i>Diospyros kaki</i> L.f.	Buah kaki, buah samak, persimmon	Major	Planted
133	<i>Diospyros malabarica</i> (Desr.) Kostel.	Komoi, kumun, malabar ebony	Minor	Planted
134	<i>Dracontomelon dao</i> (Blan.) Merr. & Rolfe.	Sengkuang	Minor	Wild, planted
135	<i>Durio dulcis</i> Becc.	Durian merah, tutong	Medium	Wild, planted
136	<i>Durio grandiflorus</i> (Mast.) Koste. & Soeg.	Durian munjit, durian hantu	Minor	Wild, planted
137	<i>Durio graveolens</i> Becc.	Durian kuning, durian rimba	Medium	Wild, planted
138	<i>Durio kutenjensis</i> (Hassk.) Becc.	Durian kuning, sekawi	Medium	Wild, planted
139	<i>Durio lowianus</i> Scort. ex King	Durian sepeh	Minor	Wild
140	<i>Durio oxleyanus</i> Griff.	Durian isu	Medium	Wild
141	<i>Durio testudinarium</i> Becc.	Durian kura-kura	Medium	Wild
142	<i>Durio zibethinus</i> Murr.	Durian kampung	Major	Wild, planted
143	<i>Dysoxylum alliaceum</i> (Bl.) Bl.	Kulim burung	Minor	Wild
144	<i>Dysoxylum excelsum</i> Bl.	Kulim burung	Minor	Wild
145	<i>Elaeis guineensis</i> Jacq.	Kelapa sawit, oil palm	Major	Planted
146	<i>Elaeocarpus angustifolius</i> Bl.	Geniteri	Minor	Planted
147	<i>Elaeocarpus ferrugineus</i> (Jack) Steud.	Medang manik	Minor	Wild
148	<i>Elaeocarpus floribundus</i> Bl.	Medang telur	Minor	Planted
149	<i>Elaeocarpus submonoceras</i> Miq.	Tamang, pensi	Minor	Wild
150	<i>Elateriospermum tapos</i> Bl.	Perah	Major	Wild, planted
151	<i>Eleiodoxa conferta</i> (Griff.) Burr.	Asam paya, kelubi	Medium	Wild, planted
152	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Lokwat	Medium	Planted
153	<i>Erythrina variegata</i> L.	Dedap, cengkering, Coral tree	Minor	Wild, planted
154	<i>Eugeissona tristis</i> Griff.	Bertam, beltap	Minor	Wild
155	<i>Eugeissona utilis</i> Becc.	Kajatao	Medium	Wild
156	<i>Eugenia pendens</i> Duth.	Kelat besar, kelat jambu	Minor	Wild
157	<i>Eugenia punctulata</i> King	Kelat paya, kelat penaga	Minor	Wild
158	<i>Eugenia scortechinii</i> King	Jambu ayer hutan	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
159	<i>Eugenia uniflora</i> L.	Cermai belanda, brazil cherry	Medium	Planted
160	<i>Excoecaria indica</i> (Willd.) Muell. Arg.	Gurah	Minor	Wild
161	<i>Fabrenbeitia pendula</i> (Hassk.) Shaw	Merenti, kop	Medium	Wild
162	<i>Feronia limonia</i> (L.) Swin.	Wood apple	Medium	Planted
163	<i>Ficus auriculata</i> Lour.	Ara, kelebok	Minor	Planted
164	<i>Ficus carica</i> L.	Buah tin, fig	Medium	Planted
165	<i>Ficus lepicarpa</i> Bl.	Kelupang gajah, saraca fig	Minor	Wild
166	<i>Ficus nota</i> (Blan.) Merr.	Labai	Minor	Wild
167	<i>Ficus obpyramidata</i> King	Ara lempong, common river fig	Minor	Wild
168	<i>Ficus racemosa</i> L.	Atika, cluster fig	Minor	Wild
169	<i>Ficus roxburghii</i> Wall.	Ara, buah tin	Minor	Planted
170	<i>Ficus sinuata</i> Thunb.	Kesenai	Minor	Wild
171	<i>Flacourtia indica</i> (Burm.f.) Merr.	Kerekup kecil, madagascar plum	Minor	Wild, planted
172	<i>Flacourtia inermis</i> Roxb.	Rukam masam, governor plum	Minor	Wild, planted
173	<i>Flacourtia jangomas</i> (Lour.) Raesch.	Rukam manis, indian plum	Medium	Planted
174	<i>Flacourtia rukam</i> Zoll. & Morit.	Rukam	Medium	Wild, planted
175	<i>Fortunella polyandra</i> Swin.	Limau pagar	Medium	Planted
176	<i>Garcinia atroviridis</i> Griff. ex Ande.	Asam gelugur	Major	Wild, planted
177	<i>Garcinia costata</i> Hemsl. ex King	Gelugur	Medium	Wild
178	<i>Garcinia cowa</i> Roxb.	Kandis	Minor	Wild, planted
179	<i>Garcinia dulcis</i> Roxb.	Mundu	Medium	Wild, planted
180	<i>Garcinia griffithii</i> Ande.	Kandis gajah	Minor	Wild
181	<i>Garcinia bombroniana</i> Pierre	Beruas	Minor	Wild
182	<i>Garcinia mangostana</i> L.	Manggis, mangosteen	Major	Planted
183	<i>Garcinia nitida</i> Pierre	Kandis	Medium	Wild, planted
184	<i>Garcinia parvifolia</i> Miq.	Kundong	Medium	Wild
185	<i>Garcinia prainiana</i> King	Cerpu, mencupu	Medium	Wild, planted
186	<i>Garcinia xanthochymus</i> Hk.f.	Asam kandis	Minor	Wild
187	<i>Genipa americana</i> L.	Huito, Marmalade box	Minor	Planted
188	<i>Gnetum gnemon</i> L.	Belinjau, melinjau	Major	Planted
189	<i>Grewia fibrocarpa</i> Mast.	Cenderai hutan	Minor	Wild
190	<i>Heritiera littoralis</i> Drya. ex Aiton	Dungun	Minor	Wild
191	<i>Horsfieldia ridleyana</i> (King) Warb.	Penarahan	Minor	Wild
192	<i>Hullettia dumosa</i> King ex Hk.f.	Sentoh bukit	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
193	<i>Hydnocarpus anthelmintica</i> Pierre ex Lanes.	Setumpol	Minor	Wild
194	<i>Iringia malayana</i> Oliv. ex Benth.	Pauh kijang	Minor	Wild
195	<i>Knema laurina</i> (Bl.) Warb.	Penarahan hitam	Minor	Wild
196	<i>Lansium domesticum</i> Corr.	Langsat, duku, dokong	Major	Wild, planted
197	<i>Lecythis ollaria</i> Loefl.	Kacang <i>sapucaia</i>	Medium	Planted
198	<i>Lepisanthes alata</i> (Bl.) Leenh.	Perupok, engkilili	Medium	Wild, planted
199	<i>Lepisanthes amoena</i> (Hassk.) Leenh.	Kelampa sowa	Minor	Wild
200	<i>Lepisanthes fruticosa</i> (Roxb.) Leenh.	Setengok	Minor	Wild, planted
201	<i>Lepisanthes rubiginosa</i> (Roxb.) Leenh.	Kelat layu	Minor	Wild
202	<i>Limonia acidissima</i> L.	Gelinggai	Minor	Planted
203	<i>Lithocarpus elegans</i> (Bl.) Hatus ex Soep.	Mempening bangkas, mempening landak	Minor	Wild
204	<i>Lithocarpus wallichianus</i> (Lindl. ex Hance) Rehd.	Mempening merah	Minor	Wild
205	<i>Litsea glutinosa</i> (Lour.) Robin.	Malek	Medium	Wild
206	<i>Litsea garciae</i> Vidal	Engkala, tangkalak	Medium	Planted
207	<i>Livistona saribus</i> (Lour.) Merr. ex Chev.	Serdang	Minor	Wild, planted
208	<i>Macadamia integrifolia</i> Maiden & Betche	Macadamia	Medium	Planted
209	<i>Malpighia glabra</i> L.	Acerola	Minor	Planted
210	<i>Malus domestica</i> Borkh.	Epal, apple	Medium	Planted
211	<i>Mangifera caesia</i> Jack	Binjai	Major	Wild, planted
212	<i>Mangifera decandra</i> Ding Hou	Binjay, beluno, mawong	Minor	Wild, planted
213	<i>Mangifera foetida</i> Lour.	Bacang	Major	Wild, planted
214	<i>Mangifera gedebe</i> Miq.	Kepi, kedepir	Minor	Wild, planted
215	<i>Mangifera griffithii</i> Hk.f.	Rawa, asam rawa	Medium	Wild, planted
216	<i>Mangifera havilandii</i> Ridl.	Asam raba, asam damaran	Minor	Wild
217	<i>Mangifera indica</i> L.	Mangga	Major	Planted
218	<i>Mangifera kemanga</i> Bl.	Kemang	Minor	Wild, planted
219	<i>Mangifera lagenifera</i> Griff.	Lanjut	Minor	Wild, planted
220	<i>Mangifera laurina</i> Bl.	Mempelam	Minor	Wild, planted
221	<i>Mangifera longipetiolata</i> King	Sepam	Minor	Wild, planted

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
222	<i>Mangifera macrocarpa</i> Bl.	Macang api	Minor	Wild, planted
223	<i>Mangifera odorata</i> Griff.	Kuini	Major	Planted
224	<i>Mangifera pajang</i> Kost.	Bambangan	Medium	Wild, planted
225	<i>Mangifera pentandra</i> Hk.f.	Pauh	Minor	Wild, planted
226	<i>Mangifera quadrifida</i> Jack.	Asam kumbang	Medium	Wild, planted
227	<i>Mangifera similis</i> Bl.	Asam, lamantan	Medium	Wild, planted
228	<i>Manilkara kauki</i> (L.) Duba.	Sauh	Minor	Planted
229	<i>Manilkara zapota</i> (L.) van Royen	Ciku, sapodilla	Major	Planted
230	<i>Meliosma sumatrana</i> (Jack) Walp.	Meggading besar	Medium	Wild
231	<i>Memecylon caeruleum</i> Jack	Delek jambu	Minor	Wild
232	<i>Memecylon edule</i> Roxb.	Delek air	Minor	Wild
233	<i>Metroxylon sagu</i> Rottb.	Rumbia	Medium	Wild, planted
234	<i>Meyna spinosa</i> Roxb.ex Link	Duri timun tahlil	Minor	Wild
235	<i>Microcos fibrocarpa</i> (Mast.) Burr.	Cenderai asam, cenderai rimba	Minor	Wild
236	<i>Microcos latifolia</i> (Mast.) Burr.	Cenderai gajah	Minor	Wild
237	<i>Microcos stylocarpa</i> (Warb.) Burr.	Kamuling	Minor	Wild
238	<i>Micropora curtisii</i> Hk.f.	Medang kaki liang	Minor	Wild
239	<i>Mimusops elengi</i> L.	Tanjung	Minor	Wild, planted
240	<i>Mischocarpus pentapetalus</i> (Roxb.) Radlk.	Rambutan pacat	Minor	Wild
241	<i>Morinda citrifolia</i> L.	Mengkudu	Minor	Wild, planted
242	<i>Moringa oleifera</i> Lamk.	Merunggai	Major	Planted
243	<i>Morus alba</i> L.	Besaram	Medium	Planted
244	<i>Muntingia calabura</i> L.	Ceri Siam	Minor	Wild, planted
245	<i>Myristica crassa</i> King	Pala hutan	Medium	Wild
246	<i>Myristica fragrans</i> Houtt.	Pala	Major	Planted
247	<i>Nauclea subdita</i> (Korth.) Steud.	Mengkal	Minor	Wild
248	<i>Nepbelium aculeatum</i> Leenh.	Rambutan utan	Minor	Wild
249	<i>Nepbelium cuspidatum</i> Bl.	Sanggul lotong, giant rambutan	Minor	Wild
250	<i>Nepbelium juglandifolium</i> Bl.	Lungsir	Minor	Wild
251	<i>Nepbelium lappaceum</i> L.	Rambutan	Major	Wild, planted
252	<i>Nepbelium maingayi</i> Hiem.	Ridan, penjaih, serait, mujau	Medium	Wild
253	<i>Nepbelium melliferum</i> Gagne.	Bok	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
254	<i>Nepbelium ramboutan-ake</i> (Labill.) Leenh.	Pulasan	Major	Wild, planted
255	<i>Nepbelium reticulatum</i> Radlk.	Buah stagok	Minor	Wild
256	<i>Nepbelium uncinatum</i> Radlk. ex Leenh.	Mentakod	Minor	Wild
257	<i>Nypa fruticans</i> Wurm.	Nipah	Medium	Wild, planted
258	<i>Nyssa javanica</i> (Bl.) Wange.	Wuru gading	Minor	Wild
259	<i>Ochanostachys amentacea</i> Mast.	Petaling	Minor	Wild
260	<i>Ochreinauclea maingayi</i> Hk.f.	Mengkal	Minor	Wild
261	<i>Ochrosia oppositifolia</i> (Lam.) Schum.	Buah sousouri, corkwood tree	Minor	Wild
262	<i>Oroxylum indicum</i> (L.) Kurz.	Kulai	Minor	Wild, planted
263	<i>Palaquim burkii</i> Lam.	Suntai	Minor	Wild
264	<i>Palaquim hexandrum</i> (Griff.) Bail.	Tanjung hutan	Minor	Wild
265	<i>Palaquim macrocarpum</i> Burc.	Nyatoh hitam	Minor	Wild
266	<i>Palaquim rostratum</i> (Miq.) Burc.	Nyatoh bukit	Minor	Wild
267	<i>Pangium edule</i> Reinw.	Kepayang	Medium	Wild
268	<i>Parartocarpus venenosus</i> (Zoll. & Morit.) Becc.	Tenggajun	Minor	Wild
269	<i>Parkia speciosa</i> Hassk.	Petai, stink bean	Major	Wild, planted
270	<i>Parkia timoriana</i> (DC) Merr.	Kerayong	Minor	Wild
271	<i>Payena leerii</i> (Teysm. & Binn.) Kurz.	Balam sundek	Minor	Wild
272	<i>Pentaspadon motleyi</i> Hk.f. ex King	Pelong, pelajau	Medium	Wild
273	<i>Persea americana</i> Mill.	Avokado	Major	Planted
274	<i>Phyllanthus acidus</i> (L.) Skeels	Cermai	Major	Planted
275	<i>Phyllanthus emblica</i> L.	Melaka	Major	Wild, planted
276	<i>Phyllanthus gompbocarpus</i> Hk.f.	Chermala hutan	Minor	Wild
277	<i>Pithecellobium bubalinium</i> Benth.	Kerdas	Major	Wild, planted
278	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Asam keranji	Minor	Planted
279	<i>Pithecellobium jiringa</i> Prain	Jering	Major	Wild, planted
280	<i>Plethiandra cuneata</i> Stapf.	Menakan	Minor	Wild
281	<i>Plethiandra bookeri</i> Stapf.	Buah menakan, jambu ara	Medium	Wild, planted
282	<i>Pometia pinnata</i> Forst.	Kasai, matoa	Minor	Wild, planted
283	<i>Porterandia anisophylla</i> (Jack ex Roxb.) Ridl.	Randa hutan	Minor	Wild
284	<i>Pouteria caimito</i> Radlk.	Abiu, caimito	Medium	Planted

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
285	<i>Pouteria campechiana</i> (Kunth.) Beahni.	Kuning telur, yellow sapote, canistel	Medium	Planted
286	<i>Pouteria sapota</i> (Jacq.) Moore & Stearn	Mamey sapote, Ciku mame	Medium	Planted
287	<i>Prunus persica</i> L.	Persik	Minor	Wild, planted
288	<i>Psidium guajava</i> L.	Jambu batu, guava	Major	Wild, planted
289	<i>Psidium littorale</i> Radd.	Strawberry guava	Medium	Planted
290	<i>Punica granatum</i> L.	Delima, pomegranate	Minor	Planted
291	<i>Pyrus pyrifolia</i> (Burm.) Nakai	Lai, oriental pear	Medium	Planted
292	<i>Reinwardtiodendron humile</i> (Hassk.) Mabb.	Kennuni	Minor	Wild
293	<i>Rinorea sclerocarpa</i> (Burg.) Jaco.	Rukap	Minor	Wild
294	<i>Rhodamnia cinerea</i> Jack	Mempoyan	Minor	Wild
295	<i>Rollinia deliciosa</i> Saff.	Brazilian custard apple	Major	Planted
296	<i>Rollinia mucosa</i> (Jacq.) Baill.	Nona besar	Major	Planted
297	<i>Ryparosa multinervosa</i> Sloo.	Pehapan ruai	Minor	Wild
298	<i>Salacca affinis</i> Griff.	Salak hutan	Medium	Wild
299	<i>Salacca conferta</i> Griff.	Asam paya, kelubi	Medium	Wild, planted
300	<i>Salacca glabrescens</i> Griff.	Salak hutan	Minor	Wild
301	<i>Salacca magnifica</i> Moge	Remayong	Minor	Wild
302	<i>Salacca wailichiana</i> Mart.	Salak kumbar, salak rengam	Minor	Wild, planted
303	<i>Salacca zallaca</i> (Gaert.) Voss	Salak	Major	Planted
304	<i>Samanea saman</i> (Jacq.) Merr.	Pokok hujan, rain tree	Minor	Planted
305	<i>Sandoricum koetjape</i> (Burm f.) Merr.	Sentul	Medium	Wild, planted
306	<i>Santiria tomentosa</i> Bl.	Kerantai bulu	Minor	Wild
307	<i>Sapium baccatum</i> Roxb.	Ludai	Minor	Wild, planted
308	<i>Sarcocephalus latifolius</i> (Sm.) Bruce	Pulasan hutan	Minor	Planted
309	<i>Sarcotheca glomerula</i> Veld.	Belimbing hutan, asam tunduh	Minor	Wild
310	<i>Sarcotheca grifitbii</i> (Planch. ex Hk.f.) Hall.f.	Pupoi	Minor	Wild
311	<i>Sarcotheca monophylla</i> (Planch. ex Hk.f.) Hall.f.	Belimbing bulat	Minor	Wild
312	<i>Scaphium linearicarpum</i> (Mast.) Pierre	Kembang semangkok bulat	Major	Wild
313	<i>Scaphium longiflorum</i> Ridl.	Kembang semangkok	Major	Wild
314	<i>Scaphium macropodon</i> (Miq.) Beum. ex Heyne	Kembang semangkok jantong	Major	Wild
315	<i>Scaphium scaphigerum</i> (Don) Guib. et Planch.	Kembang semangkok	Major	Wild
316	<i>Scorodocarpus borneensis</i> (Baill.) Becc.	Kulim	Minor	Wild

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ²	Cultivation status
317	<i>Semecarpus anarcadium</i> L.f.	Dhobi nut, marking-nut tree	Minor	Planted
318	<i>Sesbania grandiflora</i> (L.) Poir.	Kacang turi	Major	Planted
319	<i>Shorea macrophylla</i> (de Vri.) Ash.	Engkabang jantung, false illipe nut	Major	Wild, planted
320	<i>Shorea splendida</i> (de Vri.) Ash.	Engkabang bintang	Medium	Wild
321	<i>Shorea stenoptera</i> Burc.	Engkabang kerangas	Medium	Wild
322	<i>Solanum macranthrum</i> Dunal	Terung pokok, potato tree	Major	Planted
323	<i>Sonneratia alba</i> Smi.	Gedalu, berembang	Minor	Wild
324	<i>Sonneratia caseoralis</i> (L.) Engl.	Pedada, berembang	Medium	Wild
325	<i>Sonneratia griffithii</i> Kurz.	Perepat	Minor	Wild
326	<i>Spondias cytherea</i> Sonn.	Kedondong, great hog plum	Major	Planted
327	<i>Spondias mombin</i> L.	Kedondong cina, yellow mombin, thorny hog plum	Medium	Planted
328	<i>Spondias philippinensis</i> (Elm.) Shaw & Forman	Basisihan, rorsa rorsa	Medium	Planted
329	<i>Stemonurus secundifolius</i> Bl.	Lelada hutan	Minor	Wild
330	<i>Sterculia foetida</i> L.	Kelumpang jari	Minor	Wild, planted
331	<i>Sterculia monosperma</i> Vent.	Pheng phok, China chestnut	Minor	Planted
332	<i>Sterculia parvifolia</i> Wall.	Kelumpang	Minor	Wild, planted
333	<i>Streblus ilicifolius</i> (Vidal) Cor.	Lelimau hutan	Minor	Wild
334	<i>Syzygium aqueum</i> (Burm.f.) Alst.	Jambu air, water apple	Major	Planted
335	<i>Syzygium cumini</i> (L.) Skeels	Jambulan, jambolan	Medium	Planted
336	<i>Syzygium jambos</i> (L.) Alst.	Jambu mawar, rose apple	Medium	Planted
337	<i>Syzygium malaccense</i> (L.) Merr. & Perry	Jambu bol, Malay apple	Medium	Planted
338	<i>Syzygium nervosum</i> DC.	Salam	Minor	Wild, planted
339	<i>Syzygium polyanthum</i> (Wight.) Walp	Jambu hutan, kelat samak	Minor	Wild, planted
340	<i>Syzygium pynanthum</i> Merr. & Perry	Kelat jambu	Minor	Wild
341	<i>Syzygium samarangense</i> (Bl.) Merr. & Perry	Jambu air mawar, jambu semarang, Java apple	Minor	Planted
342	<i>Syzygium zeylanicum</i> (L.) DC.	Kelat nenasi	Minor	Wild
343	<i>Tamarindus indica</i> L.	Asam jawa	Major	Wild, planted
344	<i>Terminalia bellirica</i> (Gaert.) Roxb.	Jelawai	Minor	Wild
345	<i>Terminalia catappa</i> L.	Ketapang, sea almond	Minor	Wild, planted
346	<i>Terminalia chebula</i> Retz.	Manja lawai	Minor	Planted
347	<i>Tetramerista glabra</i> Miq.	Punah tembaga	Minor	Wild
348	<i>Theobroma cacao</i> L.	Koko, Cocoa	Major	Planted

(Continued)

TABLE 3 (Continued)

Bil	Species	Common names	Economic status ^z	Cultivation status
349	<i>Vitex glabrata</i> R.Br.	Leban keling	Minor	Wild
350	<i>Xanthophyllum amoenum</i> Chod.	Langir, nyalin	Medium	Wild
351	<i>Xanthophyllum obscurum</i> Benn.	Buah kapas	Minor	Wild
352	<i>Xerospermum laevigatum</i> Radlk.	Rambutan pachat, gong	Minor	Wild
353	<i>Xerospermum noronbianum</i> (Bl.) Bl.	Balong ayam, kata keran	Minor	Wild
354	<i>Ximenia americana</i> L.	Bidara laut	Minor	Wild
355	<i>Zizyphus mauritiana</i> Lamk.	Bidara, Indian jujube	Minor	Wild, planted

^zEconomic status refers to the relative value of the edible fruits or seeds to the locals.

TABLE 4 Species List of Non-Trees Producing Edible Fruits or Seeds in Malaysia

No.	Species	Common names	Habit	Status
1	<i>Abelmoschus esculentus</i> L.	Bendi, okra	Herb	Planted
2	<i>Amomum compactum</i> Sol. ex Mat.	Kepulaga, round cardamom	Herb	Planted
3	<i>Amomum lappaceum</i> Ridl.	Tepus	Herb	Wild
4	<i>Ampelocissus martini</i> Planc.	Anggur hutan	Woody climber	Wild, planted
5	<i>Ananas comosus</i> (L.) Merr.	Nanas, pineapple	Herb	Planted
6	<i>Anomianthus dulcis</i> (Dunal) Sincl.	Akar pisang-pisang hitam	Woody climber	Wild
7	<i>Antidesma stipulare</i> Bl.	Buah tahi kambing	Shrub	Wild
8	<i>Antidesma velutinsum</i> Bl.	Mempunai bukit	Shrub	Wild
9	<i>Arachis hypogaea</i> L.	Kacang tanah, ground nut	Shrub	Planted
10	<i>Ardisia crispa</i> DC.	Mata pelandok	Shrub	Wild
11	<i>Benincasa hispida</i> (Thunb. ex Murr.) Cogn.	Kundur, wintermelon	Herbaceous climber	Planted
12	<i>Cajanus cajan</i> (L.) Millsp.	Kacang dal	Herbaceous climber	Planted
13	<i>Calamus ornatus</i> Bl.	Rotan dok	Woody climber	Wild, planted
14	<i>Calamus paspalanthus</i> Becc.	Rotan sirikis, wi singkau, wi lohong	Woody climber	Wild
15	<i>Calamus subinermis</i> Wendl. ex Becc.	Rotan batu, rotan tunggal	Woody climber	Wild, planted
16	<i>Calospatha scortechinii</i> Becc.	Rotan demuk	Woody climber	Wild
17	<i>Canavalia gladiata</i> DC.	Kacang parang, sword bean	Herbaceous climber	Planted
18	<i>Canavalia rosea</i> DC.	Kacang laut	Herbaceous climber	Wild
19	<i>Capparis micracantha</i> DC.	Melada	Shrub	Wild
20	<i>Capsicum annum</i> L.	Cabai, cili	Herb	Planted

(Continued)

TABLE 4 (Continued)

No.	Species	Common names	Habit	Status
21	<i>Capsicum frutescens</i> L.	Cili burung, cabai burung	Herb	Wild, planted
22	<i>Carica papaya</i> L.	Betik, papaya	Herb	Planted
23	<i>Carissa carandas</i> L.	Kerandang, berenda	Shrub	Planted
24	<i>Carissa congesta</i>	Karaunda	Shrub	Planted
25	<i>Cassia alata</i> L.	Gelenggang, golden candlesticks	Shrub	Wild, planted
26	<i>Cassia occidentalis</i>	Kacang kota	Shrub	Wild
27	<i>Cassia tora</i> L.	Gelenggang kecil	Herb	Wild
28	<i>Champereia manillana</i> (Bl.) Merr.	Cemperai	Shrub	Wild
29	<i>Citrullus lunatus</i> (Thunb). Mansf.	Tembikai, watermelon	Herbaceous climber	Planted
30	<i>Clidemia hirta</i> (L.) Don	Senduduk bulu, senduduk paksa, soapbush	Shrub	Wild
31	<i>Coccinia grandis</i> (L.) Voig.	Pepasan	Herbaceous climber	Wild, planted
32	<i>Coix lachryma-jobi</i> L.	Jelai, Job's tears	Herb	Wild, planted
33	<i>Crotolaria striata</i> DC	Giring-giring	Shrub	Wild
34	<i>Cucumis melo</i> L.	Tembikai wangi, honey-dew melon	Herbaceous climber	Planted
35	<i>Cucumis sativus</i> L.	Timun, cucumber	Herbaceous climber	Planted
36	<i>Cucurbita filicifolia</i> Bouche	Labu putih, black seed squash, shark's fin gourd	Herbaceous climber	Planted
37	<i>Cucurbita maxima</i> Duch. ex Lam.	Labu merah, pumpkin, squash	Herbaceous climber	Planted
38	<i>Cucurbita moschata</i> (Duch. ex Lam.) Duch.ex Poir	Labu merah, pumpkin, squash	Herbaceous climber	Planted
39	<i>Cucurbita pepo</i> Duch ex Lam	Labu kastard, summer squash	Herbaceous climber	Planted
40	<i>Curculigo capitulata</i> Drya.	Lumbah	Herb	Wild
41	<i>Curculigo latifolia</i> Drya.	Lumbah	Herb	Wild
42	<i>Daemonorops</i> <i>didymophylla</i> Becc.	Rotan jergang, udat	Woody climber	Wild
43	<i>Daemonorops bystrix</i> (Griff.) Mart.	Rotan tahi landak, wi duduk, wae dangah	Woody climber	Wild
44	<i>Daemonorops ingens</i> Dransf.	Keplar, wi darum, wi seruing	Woody climber	Wild
45	<i>Daemonorops periacantha</i> Miq.	Rotan belubu, wi empunoh	Woody climber	Wild
46	<i>Daemonorops ruptilis</i> Becc.	Wi duduk	Woody climber	Wild
47	<i>Daemonorops scapigera</i> Becc.	Ruai, wi empunok	Woody climber	Wild
48	<i>Dolichos lablab</i> L.	Kacang kara	Herb	Planted
49	<i>Elaeagnus conferta</i> Roxb.	Kakaduan	Woody climber	Planted

(Continued)

TABLE 4 (Continued)

No.	Species	Common names	Habit	Status
50	<i>Embelia ribes</i> Burm.f.	Akar sulur kerang	Woody climber	Wild
51	<i>Etilingera elatior</i> (Jack) Smith	Buah kantan, torch ginger	Herb	Wild, planted
52	<i>Etilingera littoralis</i> (Koenig.) Giseke	Kedungkel	Herb	Wild
53	<i>Etilingera punica</i> (Roxb.) Smith	Chalong	Herb	Wild
54	<i>Ficus montana</i> Burm.f.	Kesinan	Shrub	Wild
55	<i>Ficus sinuata</i> Thunb.	Mepai	Shrub	Wild
56	<i>Fortunella margarita</i> (Lour.) Swingle	Oval kumquat	Shrub	Planted
57	<i>Fortunella polyandra</i> (Ridl.) Tanaka	Kumquat	Shrub	Planted
58	<i>Fragaria vesca</i> L.	Strawberri	Herb	Planted
59	<i>Friesodielsia biglandulosa</i> (Bl.) Steenis	Pisang-pisang hitam	Woody climber	Wild
60	<i>Gaultheria punctata</i> Bl.	Mountain berry	Shrub	Wild
61	<i>Glycine max</i> (L.) Merr.	Soya	Herb	Planted
62	<i>Gnetum latifolium</i> Bl.	Akar tutubo, akar suburus	Woody climber	Wild
63	<i>Gnetum tenuifolium</i> Ridl.	Akar putat	Woody climber	Wild
64	<i>Gnetum gnemonoides</i> Brogn.	Akar ganemu	Woody climber	Wild
65	<i>Helianthus annuus</i> L.	Bunga matahari, sunflower	Herb	Planted
66	<i>Hibiscus sabdariffa</i> L.	Asam susur, rosel	Herb	Planted
67	<i>Hodgsonia capniocarpa</i> Ridl.	Akar kepayang	Woody climber	Wild
68	<i>Hornstedtia alliacea</i> (Teysm. & Binned.) Val.	Ketanim	Herb	Wild
69	<i>Hornstedtia metriocheilus</i> (Griff.) Ridl.	Tepus, lengkuas hutan	Herb	Wild
70	<i>Hornstedtia minor</i> (Bl.) Schum.	Lanang	Herb	Wild
71	<i>Hornstedtia pininga</i> (Bl.) Val.	Ranjang	Herb	Wild
72	<i>Hornstedtia tomentosa</i> (Bl.) Bakh.f.	Totot	Herb	Wild
73	<i>Kadsura scandens</i> (Bl.) Bl.	Akar dama-dama, belebar	Woody climber	Wild
74	<i>Lagenaria siceraria</i> (Molina) Standl.	Labu putih, bottle gourd	Herbaceous climber	Planted
75	<i>Lantana camara</i> L.	Bunga tahi ayam	Bush, climber	Wild, planted
76	<i>Luffa acutangula</i> (L.) Roxb.	Petola segi, angled loofah	Herbaceous climber	Planted
77	<i>Luffa aegyptiaca</i> Mill.	Petola buntal, smooth loofah	Herbaceous climber	Wild, planted
78	<i>Lycium chinense</i> Mill.	Kauki, Chinese boxthorn	Shrub	Planted

(Continued)

TABLE 4 (Continued)

No.	Species	Common names	Habit	Status
79	<i>Lycopersicon esculentum</i> Mill.	Tomato	Herb	Planted
80	<i>Medinilla crassifolia</i> (Bl.) Bl.	Asam lokan	Shrub	Wild
81	<i>Melastoma malabathrium</i> L.	Senduduk	Shrub	Wild
82	<i>Melastoma polyanthum</i> Bl.	Sunduduk	Shrub	Wild
83	<i>Melodinus monogynus</i> Roxb.	Getah ujul	Woody climber	Wild
84	<i>Milletia eriantha</i> Benth.	Akar koyah	Woody climber	Wild
85	<i>Momordica charantia</i> L.	Peria, bitter gourd	Herbaceous climber	Planted
86	<i>Momordica cochinchinensis</i> Spre.	Teruah	Woody climber	Wild
87	<i>Morinda umbellata</i> L.	Akar mengkudu	Woody climber	Wild
88	<i>Musa</i> L. hybrids	Pisang, banana	Herb	Planted
89	<i>Nelumbo nucifera</i> Gaertn.	Teratai, lotus	Aquatic herb	Wild, planted
90	<i>Nymphaea nouchali</i> Burm.f.	Seroja, water lily	Aquatic herb	Wild, planted
91	<i>Ocimum basilicum</i> L.	Selasih jantan, sweet basil	Herb	Wild, planted
92	<i>Ocimum tenuiflorum</i> L.	Ruku-ruku, holy basil	Herb	Wild, planted
93	<i>Oryza sativa</i> L.	Padi	Herb	Planted
94	<i>Pachyrrhizus erosus</i> Urb.	Sengkuang	Herbaceous climber	Planted
95	<i>Pandanus furcatus</i> Roxb.	Mengkuang hutan	Herb	Wild
96	<i>Passiflora edulis</i> Sims	Markisa	Herbaceous climber	Planted
97	<i>Passiflora foetida</i> L.	Letup-letup	Herbaceous climber	Wild
98	<i>Passiflora laurifolia</i> L.	Buah susu, buah selasih	Woody climber	Planted
99	<i>Passiflora quadrangularis</i> L.	Timun belanda, giant granadilla	Herbaceous climber	Planted
100	<i>Pavetta indica</i> L.	Jarum-jarum	Shrub	Wild, planted
101	<i>Phaleria capitata</i> Jack	Kekapasan	Shrub	Planted
102	<i>Phaseolus lunatus</i> L.	Kacang cina	Herbaceous climber	Planted
103	<i>Phaseolus vulgaris</i> L.	Kacang buncis	Herbaceous climber	Planted
104	<i>Physalis minima</i> L.	Cipluan, letup-letup	Herb	Wild
105	<i>Physalis peruviana</i> L.	Ceplukan, cape gooseberry	Herb	Planted
106	<i>Piper nigrum</i> L.	Lada, pepper	Herbaceous climber	Planted
107	<i>Pisum sativum</i> L.	Kacang manis, sweet pea	Herbaceous climber	Planted

(Continued)

TABLE 4 (Continued)

No.	Species	Common names	Habit	Status
108	<i>Plantago major</i> L.	Ekor anjing	Herb	Wild, planted
109	<i>Potentilla indica</i> (Andr.) Wolf	Strawberri India	Herb	Planted
110	<i>Psophocarpus tetragonolobus</i> (L.) DC	Kacang botor, 4-angled bean	Herbaceous climber	Planted
111	<i>Rhodomyrtus tomentosa</i> (Aiton) Hassk.	Kemunting	Shrub	Wild, planted
112	<i>Rubus fraxinifolius</i> Poiret	Ragimot	Shrub	Wild
113	<i>Rubus niveus</i> Thunb.	Raspberry	Shrub	Wild, planted
114	<i>Salacia chinensis</i> L.	Mata kucing hutan, Rakiat hutan	Shrub or liana	Wild
115	<i>Salacia grandiflora</i> Kurz	Mempedal ayam, nasi sejuk	Shrub or liana	Wild
116	<i>Salacia korthalsiana</i> Miq.	Akar beting, akar menjela	Liana	Wild
117	<i>Salacia macrophylla</i> Bl.	Hempedal itik, nasi sejuk	Shrub or liana	Wild
118	<i>Salacia viminea</i> Wall. ex Law.	Nasi sejuk	Shrub	Wild
119	<i>Sarcolobus globosus</i> Wall.	Akar pelir kambing	Woody climber	Wild
120	<i>Sauropus androgynus</i> (L.) Merr.	Cekur manis	Shrub	Wild, planted
121	<i>Seebium edule</i> (Jacq.) Swartz	Labu siam, cayote	Herbaceous climber	Planted
122	<i>Sesamum orientale</i> L.	Bijan, sesame	Herb	Planted
123	<i>Sicana odorifera</i> (Vell.) Naud.	Cassabanana, musk cucumber	Herbaceous climber	Planted
124	<i>Solanum aculeatissimum</i> Jacq	Terung perat	Herb	Wild
125	<i>Solanum americanum</i> Mill.	Ranti	Herb	Wild, planted
126	<i>Solanum blumei</i> Nees	Terung catur	Shrub	Planted
127	<i>Solanum erianthum</i> Don	Terung rimba	Shrub	Wild
128	<i>Solanum ferox</i> L.	Terung bulu, terung asam	Herb	Wild, planted
129	<i>Solanum macrocarpon</i> L.	Terung rapoh	Shrub	Planted
130	<i>Solanum mammosum</i> L.	Terong susu	Shrub	Planted
131	<i>Solanum melongena</i> L.	Terong, eggplant	Shrub	Planted
132	<i>Solanum nigrum</i> L.	Terung telunjuk	Herb	Wild, planted
133	<i>Solanum torvum</i> Swartz	Terung pipit	Shrub	Wild, planted
134	<i>Solanum violaceum</i> Orte.	Terung pipit	Shrub	Wild, planted
135	<i>Sorghum bicolor</i> (L.) Moen.	Sorghum	Herb	Wild, planted
136	<i>Sphaerocoryne aberrans</i> Ridl.	Akar bunga tanjong	Woody climber	Wild

(Continued)

TABLE 4 (Continued)

No.	Species	Common names	Habit	Status
137	<i>Thaumatococcus danellii</i> Benth.	Katamfe, sweet prayer	Herb	Planted
138	<i>Trichosanthes cucumerina</i> L.	Petola ular	Herbaceous climber	Planted
139	<i>Tripthasia trifolia</i> (Burm.f.) Wils.	Limau kiah	Shrub	Planted
140	<i>Uvaria cordata</i> (Dunal) Alston	Akar pisang-pisang jantan, bunga jari hutan	Woody climber	Wild
141	<i>Uvaria grandiflora</i> Roxb.	Akar larak, akar pisang-pisang tandok	Woody climber	Wild
142	<i>Uvaria rufa</i> Bl.	Pisang-pisang, larak	Woody climber	Wild
143	<i>Tetrastigma lanceolarium</i> (Roxb.) Planc.	Akar cabang limah	Woody climber	Wild
144	<i>Tetrastigma lawsonii</i> (King) Burk.	Akar papan	Woody climber	Wild
145	<i>Tripthasia trifolia</i> Wils.	Limau kiah, lime berry	Shrub	Wild, planted
146	<i>Vaccinium bracteatum</i> Thunb.	Inai batu, mata keli, sea bilberry	Shrub	Wild
147	<i>Vaccinium littoreum</i> Miq.	Padang	Shrub	Wild
148	<i>Vallaris solanacea</i> (Roth.) Kuntz.	Kerak nasi, bread flower	Woody climber	Planted
149	<i>Vangueria madagascariensis</i> Gmel.	Spanish tamarind	Shrub	Planted
150	<i>Vanilla griffithii</i> Reich.f.	Akar penubal, telinga kerbau	Herbaceous climber	Wild, planted
151	<i>Vanilla planifolia</i> Andr.	Vanilla	Herbaceous climber	Planted
152	<i>Vigna radiata</i> (L.) Wilc.	Kacang hijau, green gram	Herbaceous climber	Planted
153	<i>Vigna subterranea</i> (L.) Verd.	Kacang bogor, bambara groundnut	Herb	Planted
154	<i>Vigna umbellata</i> (Thunb.) Ohwi & Ohasi	Kacang sepalit, rice bean	Herbaceous climber	Planted
155	<i>Vigna unguiculata</i> (L.) Walp. cv. biflora	Kacang merah, cowpea	Herbaceous climber	Planted
156	<i>Vigna unguiculata</i> (L.) Walp. cv. sesquipedalis	kacang panjang, long bean	Herbaceous climber	Planted
157	<i>Vitis vinifera</i> L.	Anggur, grape	Woody climber	Planted
158	<i>Willughbeia angustifolia</i> (Miq.) Mark.	Gerit-gerit	Woody climber	Wild
159	<i>Willughbeia coriacea</i> Wall.	Akar getah gaharu	Woody climber	Wild
160	<i>Willughbeia edulis</i> Roxb.	Akar jitan	Woody climber	Wild
161	<i>Willughbeia tenuiflora</i> Dyer ex Hk.f.	Akar getah gerip	Woody climber	Wild
162	<i>Zea mays</i> L.	Jagung, maize, corn	Herb	Planted

(Continued)

TABLE 4 (Continued)

No.	Species	Common names	Habit	Status
163	<i>Zebneria marginata</i> (Blme) Kerau.	Timun tikus	Herbaceous climber	Wild
164	<i>Ziziphus calophylla</i> Wall.	Kuku lang rimba	Woody climber	Wild
165	<i>Zizyphus kunstleri</i> King.	Kuku menaul	Woody climber	Wild

DISCUSSION

This study compiled all the currently known species of plants that produce edible fruits or seeds in Malaysia. Other findings from this study are summarized as follows:

1. Most species of plants that produce edible fruits or seeds in Malaysia are trees.
2. Most species of fruit trees fall into the “minor” economic status category.
3. Most species of fruit trees in the “major” economic status category are planted.
4. Most species of fruit trees in the “minor” economic status category are wild.
5. Economic status “medium” consists of a mix of wild and planted species, but is dominated in numbers by species that are either wild or planted.
6. Most species of fruit plants (trees and non-trees) that produce edible fruits or seeds are wild.

Economic status of each species of fruit tree indicates its relative importance as a source of income to the local people. Economic status of non-tree species was not discussed because they are usually grown for self consumption or also for other uses, such as ornamentals, rituals, and medicine, by the local people. The planting status of each species of plant that produce edible fruits or seeds indicates its vulnerability to unsustainable fruit harvesting that subsequently threatens the conservation of fruit plant species. As the environmental cost and benefit of a project or activity also encompasses the cost of resettlement of people and biodiversity loss, information in this article can readily be used as checklists and as a basis for formulating compensation methods, and as a reference for species of plants that produce edible fruits or seeds in the environmental impact assessments in Malaysia.

Every plant has its use and non-use values. For plants that produce edible fruits or seeds, its use value includes the livelihood provided from their fruits, timberwood from their trees, and the ecological services that

they provide. Non-use values of plants that produce edible fruits or seeds include their contribution to the biodiversity of the area and to the culture and heritage of the local people. Both the use and non-use values of plants that produce edible fruit or seeds depend on its species. Therefore, characteristics, such as reproduction biology, survivorship, and the conservation status of the species, are useful in estimating their potential to produce fruits or other services. In view of the guidelines provided by the Department of Environment of Malaysia (2009), it is proposed that the total economic value of a fruit plant should be the sum of their use value and non-use value. This formula is shown below:

$$\begin{aligned} \text{Total economic value of a fruit plant} &= \text{Use value of a fruit plant} \\ &+ \text{Non-use value of a fruit plant.} \end{aligned}$$

The use value of a fruit plant can be calculated by using net present value (NPV) as suggested by Ricker et al. (1999). Net present value is the difference between the cost and the present value of future cash flows. The positive net present value, as shown in the equation below is used to project future long-term tree growth and fruit production. This model assumes an expected average commercial value of a tree without any replanting to replace dead trees. Prices and costs are also assumed to remain constant over time.

$$NPV = \sum_{i=1}^{MA} [F_i S_i (P - C) e^{-ri}] - K.$$

In the equation above, i denotes the age as a discrete integer number. Planting occurs at $i = 0$ and MA is the maximum age of production. The variable F_i is the expected annual fruit yield of the tree at age i , while S_i is the expected survivorship at age i (S_i ranges between 0 and 1). The economic parameters are the per-unit market fruit price P ; the per-unit cost C for harvesting, transportation, and marketing; and the discount rate (r) reflects the value of time for an investor (e.g., a year is worth a 6%–7% increase of invested money in Malaysia). K represents total of the present values of all planting, management, and equipment costs, which includes seedling, nursery costs, seedling and site preparation, planting costs, watering costs, and weeding costs. The first equation estimates the expected net return of the annual fruit yield in a given year $F_i S_i (P - C)$, and discounts it by multiplying with e^{-ri} . It then sums up the present values of all net returns and subtracts the present value of the management costs K . To adopt the formula as proposed by Ricker et al. (1999) for future studies information on biological characteristics of a tree, such as tree age, maximum production, expected survival, and fruit yield, needs to be collected.

This study also provides insights on the threats to fruit resources in Malaysia. Based on Tables 3 and 4, a considerable number of species of fruit-producing plant species are exclusively wild (225 species or 43.3%). Wild fruit-producing plants, especially those that are found in forests, such as tree species and lianas, are vulnerable to population decline, subsequent stock depletion, and eventually extinction. A study by Saw et al. (1991) indicates that they are mostly found in the lowland rainforest. Any human activities or natural events that disturb these forests threaten the survival of the wild fruit-producing plants. The cutting down of trees to collect their fruits can result in resource depletion. This is a practice by native tribes, such as the Bidayuh in Sarawak (Lee, 2004). In Malaysia, in-situ and ex-situ conservation strategies have been adopted to protect its biodiversity and to ensure the sustainable use of its forest resources. National parks, forest reserves, and wildlife sanctuaries are examples of the former. Ex-situ conservation for plants includes botanic gardens and arboreta. Many species of wild edible fruit-producing plants are protected since they are also found in national parks, forest reserves, and even planted in botanical gardens and arboreta. Law et al. (1991) recorded from Pasoh Forest Reserve in Malaysia a total of 76 species of wild species of trees that produce edible fruits. Species of fruit trees of the genera *Averrhoa*, *Durio*, *Garcinia*, *Mangifera*, and *Nephelium* are a part of the living collections of the Botanic Garden of the University of Malaya (Abdul Majid, 2000).

Domestication is defined as the selection of wild plants and animals for adaptation to cultivation and human use (Paran and van der Knaap, 2007). Domestication is a means to achieve biodiversity conservation by reducing the exploitation pressure exerted on useful plants in their natural habitats (Kessey, 1998). With respect to wild fruit plants, domestication can reduce fruit harvesting pressure exerted on the plants in the wild. However, such a strategy has not been adopted by conservation agencies in Malaysia. The native people of Malaysia are believed to have been already involved in domesticating several species of fruit plants. Rambo (1979) mentioned how a group of native people of Peninsular Malaysia, the Temiar, was involved in the domestication of *Parkia speciosa*. Rambo (1979) also noted that certain fruit plants derived from planted stocks persisted in abandoned clearings, allowing back-crossing with their wild relatives. The extent of back-crossing between planted species with their wild relatives has not been documented and, hence, their effect on the conservation of fruit plant genetic resources requires further studies. Nevertheless, these are evident from existence of plant species with a planting status of wild or planted as seen in Tables 3 and 4. It is important to note that Malaysia belongs to the Southern Islands belt of the Southeast Asia center of origin for domesticated plants (Li, 1970). Among the species of fruit plants that originate from the Southern Island belt are *Lansium domesticum*, *Durio zibethinus*, and *Musa paradisiaca*. According to Engels et al. (2006), centers of origin for domesticated plants are of critical

importance for current and future crop improvement efforts as they harbor major parts of the genetic diversity of a given gene pool including the domesticated species as well as their wild and weedy relatives.

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