

The Ethnobotany of *Citrus* and Their Relatives

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Abstract

The *Citrus* family, Rutaceae, is an extremely important family and well known throughout the world, being the source of all types of citrus fruits, which are economically very important products in the world market. Other products of this family includes savoury, spices and essential oils as well as being used as ornamental plants and a minor source of timber for some species in certain places. This paper looks at Rutaceae in the local Malaysian context with emphasis on traditional uses rather than the role of this family in the Malaysian market economy, although brief mention is made of various species available in the Malaysian market. Rutaceae is a large family of trees, shrubs and climbers, or rarely herbs. Although well known in the agricultural sector, various species of this family are to be found in most types of Malaysian forests such as mangrove, peat swamp, lowland forests up to the montane forest. One area of emphasis in this paper focuses on the use of various species in the field of traditional medicine. This is looked at from the aspect of recorded uses as well as from studies conducted among some Malay communities as well as the Orang Asli. The conservation status of *Citrus* and its relatives is also examined.

Introduction

Rutaceae is a large family of trees, shrubs and climbers, or rarely herbs with characteristic oil glands in the bark, fruit walls and/or leaves. The oil glands in the leaves appear either as dark green spots on the under surface or as transparent spots when the leaf is held against light. The presence of these essential oils is one reason that many species are used in local medicine. Commercially, however, this family is most important as a source of well known fruits such as oranges, lemons, limes, citrons, grapefruits, pomelos, mandarins, tangerines, etc. The family is also a source of less well known fruits such as kumquats, limeberries,

calamondins, bel fruits, wood apples, etc. Members of this family are also planted as ornamentals and other uses include savoury and spices, essential oils and source of wood.

In the world there are about 150 genera and 1,600 species in this family, found throughout the tropical and warm temperate regions, especially abundant in arid zones. In Peninsular Malaysia there are 19 genera and about 60 species. They are found in most forest types but commonest in dry regions and rare in high montane areas. A few species can be found in coastal areas including mangrove forests and several species grow on limestone hills. In the lowland rain forests members of this family is probably least common. Many species in this family are rare to very rare and many are seldom found in flower or fruit.

Results and Discussions

It is most common to associate *Citrus* and their relatives as sources of fruits and this is reflected in the local fruits markets, whether it is rural open air markets or urban air-conditioned supermarkets. Some species are commonly found in the markets but others are consumed locally only by a small number of people. Some examples are given in table 1.

All the species are planted mainly for their fruits which may be eaten directly (*Citrus grandis*, *C. paradisi*, *C. reticulata*, *C. sinensis*, *Aegle marmelos*, *Feronia limonia*) or used to make drinks (*C. aurantifolia*, *C. limon*, *C. madurensis*). Some species are also used for flavouring food or cooked as food itself (*C. aurantifolia*, *C. limon*, *C. madurensis*), or used in traditional medicine (*C. aurantifolia*, *C. grandis*, *C. madurensis*, *A. marmelos*, *F. limonia*). Other parts besides the fruits such as the leaves, bark or/and roots are also used in some species as medicine or/and in religious rituals (*C. grandis*, *A. marmelos*, *F. limonia*). *Citrus* and their relatives have significant traditional uses, i.e. important ethnobotanically, among the Chinese, Indians, Malays and the Orang Asli. For uses in traditional medicine, many species are also obtained from the forests and utilised locally or marketed internationally. This is true not only in Malaysia but also in India and China. *Aegle marmelos* is native to India where plants can be found in cultivation and in the forests. A number of varieties are said to exist with the forest variety being most potent in traditional medicine. Thus wild varieties are subjected to more exploitation than others. Traditional medicine from China is sold widely and extensively all over the world wherever Chinese communities are to be found in residence. In Malaysia we are more familiar with domesticated species of *Citrus* and their relatives as being useful but many wild species are being used by the Orang Asli and Malay communities in their practice of traditional medicine, in magic and rituals, and for the wood. Since traditional medicine normally involves the usage of plant roots, collection is destructive and many species face pressure from over exploitation.

Table 2 contains the list of species from Rutaceae that are used in Malaysia. The list contains 33 species of which 17 species, i.e. more than 50% are either endemic or threatened

Table 1. Rutaceae Species in the Malaysian market.

1	<i>Citrus aurantifolia</i> Swingle	Limau nipis, lime.
2	<i>Citrus grandis</i> (L.) Osbeck (<i>C. maxima</i> Merr.)	Limau besar, limau bali, pomelo.
3	<i>Citrus limon</i> Burm. f. (<i>C. limonia</i> Osbeck)	Lemon.
4	<i>Citrus madurensis</i> Loureiro (<i>C. microcarpa</i> Bunge)	Limau kasturi.
5	<i>Citrus medica</i> L.	Limau susu, limau mata kerbau, citron.
6	<i>Citrus paradisi</i> Macf.	Grapefruit.
7	<i>Citrus reticulata</i> Blanco (<i>C. nobilis</i> Lour.)	Limau cembul, limau langkat, tangerine.
8	<i>Citrus sinensis</i> Osbeck (<i>C. aurantium</i> L. var. <i>sinensis</i> L.)	Limau cula, sweet orange.
9	<i>Aegle marmelos</i> (L.) Corr.	Bilak, bel fruit.
10	<i>Feronia limonia</i> (L.) Swingle	Gelinggai, wood apple.

Table 2. Rutaceae Species Used in Malaysia. Compiled by the author through ethnobotanical studies and reference to publications.

No.	Species/(Status)	Uses/Communities
1	<i>Acronychia pedunculata</i> (L.) Miq. [Threatened]	Med., wood, charcoal, incense, poison (Malay, Orang Asli)
2	<i>A. porteri</i> Hk. f. [Endemic]	Wood (Malay)
3	<i>Aegle marmelos</i> Correa (Introduced)	Med., food, wood (Indian, Chinese, Malay)
4	<i>Atalantia monophylla</i> DC. [Threatened]	Med. (Malay, Orang Asli)
5	<i>A. roxburghiana</i> Hook. f. [Endemic]	Med. (Malay, Orang Asli)
6	<i>A. simplicifolia</i> (Roxb.) Engl. (Native)	Med. (Malay, Orang Asli)
7	<i>Citrus aurantifolia</i> (Christm.) Swingle (Native)	Med., food, ritual (Malay, Chinese, Indian, Orang Asli)
8	<i>C. grandis</i> (L.) Osbeck (Introduced)	Med., food, ritual (Malay, Chinese, Indian, Orang Asli)
9	<i>C. hystrix</i> DC. [Threatened]	Med., food, ritual (Malay, Chinese, Indian, Orang Asli)

Table 2. Continued.

10	<i>C. limon</i> (L.) Burm. f. (Introduced)	Food (Malay, Chinese, Indian)
11	<i>C. madurensis</i> Loureiro (Introduced)	Med., food, ritual (Malay, Chinese, Indian, Orang Asli)
12	<i>C. medica</i> L. (Introduced)	Med., food, ritual (Malay, Chinese, Indian)
13	<i>C. paradisi</i> Macf. (Introduced)	Food (Malay, Indian, Chinese)
14	<i>C. reticulata</i> Blanco (Introduced)	Food, ritual (Malay, Indian, Chinese, Orang Asli)
15	<i>C. sinensis</i> Osbeck (Introduced)	Food, ritual (Malay, Indian, Chinese, Orang Asli)
16	<i>Clausena excavata</i> Burm. f. [Threatened]	Med., wood, ritual (Malay, Orang Asli)
17	<i>Euodia glabra</i> (Bl.) Bl. [Threatened]	Wood (Malay)
18	<i>E. latifolia</i> DC. [Threatened]	Med., resin, soap (Malay, Orang Asli)
19	<i>E. roxburghiana</i> (Cham.) Benth [Threatened]	Med., food, ritual (Malay, Orang Asli)
20	<i>Feronia limonia</i> (L.) Swingle (Introduced)	Med., food (Indian, Malay, Chinese)
21	<i>Fortunella polyandra</i> (Ridley) Tanaka [Endemic]	Food, ornamental (Malay, Chinese, Indian)
22	<i>Glycosmis pentaphylla</i> (Retz.) Corre [Threatened]	Med. (Malay)
23	<i>G. puberula</i> Lindl. [Threatened]	Med. (Malay)
24	<i>Luvunga sarmentosa</i> (Bl.) Kurz. (Native)	Med. (Malay)
25	<i>L. scandens</i> (Roxb.) Buch.-Ham. (Native)	Med., ritual (Malay, Orang Asli)
26	<i>Merrillia caloxylon</i> (Ridley) Swingle [Threatened]	Med., wood (Malay)
27	<i>Micromelum hirsutum</i> Oliv. [Threatened]	Med. (Malay, Orang Asli)
28	<i>M. minutum</i> (Forst. f.) W.&A. [Threatened]	Med. (Malay, Orang Asli)

Table 2. Continued.

30	<i>M. paniculata</i> (L.) Jack (Native)	Med., ritual (Malay, Chinese)
31	<i>Paramignya scandens</i> Griff. Craib [Endemic]	Med. (Malay, Orang Asli)
32	<i>Ruta graveolens</i> L. (Introduced)	Med., ritual (Malay, Chinese, Indian, Orang Asli)
33	<i>Zanthoxylum myriacanthum</i> Wall ex Hook [Threatened]	Med., wood (Malay, Orang Asli)
29	<i>Murraya koenigii</i> Spr. (Introduced)	Food (Indian, Malay, Chinese)

species of Peninsular Malaysia. The status of threatened or endemic is according to lists published by IUCN (1991) for Peninsular Malaysia. The uses listed in the table are compiled through ethnobotanical observations of plant usage among the Orang Asli and Malays to a larger extent and of the Chinese and Indians to a lesser extent and also by reference to publications.

Thus the list have more references to the Orang Asli and Malays than to the other two ethnic groups. This study does not compare plant utilisation by different ethnic groups.

We will now look at some of the species used in Malaysia. There are two species of *Acronychia* in Peninsular Malaysia, both are trees. Wood from both species are used for making traditional houses. Pounded bark, leaves or roots of *Acronychia pedunculata* are used externally to treat pain in the joints and for various skin complaints.

Aegle marmelos is a tree of Indian origin which is now widely cultivated. In Malaysia this species is mostly cultivated by the Indian communities. The Malay and Chinese communities to a lesser extent also plant and use this species. The fruits are used as an astringent and used for treating diarrhoea and dysentery. The mature but unripe fruits are dried and broken into pieces before being boiled and taken orally. The pulp of ripe fruits is mashed and eaten.

There are two native species of *Atalantia* in Peninsular Malaysia, *Atalantia monophylla* and *Atalantia roxburghiana*, both are spiny shrubs or treelets in the forests. Pounded leaves are used externally for stomachache and respiratory complaints. A third species, *Atalantia simplicifolia* is introduced and cultivated for similar purposes.

As in most countries, *Citrus* is the most commonly used genus in the Rutaceae family. There are nine species of *Citrus* in table 2. Within each species there are many varieties. Hybridisation also occur naturally. *Citrus aurantifolia* is sliced into pieces and dipped into

sulphur powder and rubbed on the skin to get rid of fungal infections. Salted fruits are mashed in water and used as a remedy for coughs and sore throats. Fresh juice taken daily is used as a remedy for high blood pressure. The fruits are used in ritual ceremonies for healing and other magical uses. *Citrus grandis* is a well known fruit as food and also used in offerings to the spirits. The leaves are also placed on altars for worshipping spirits. Fruit peels (the skin) is dried, then boiled in water and used as bath water for skin complaints. The leaves of *Citrus hystrix* is used for flavouring food. The fruits are used in ritual healing and other magical practices. *Citrus madurensis* is widely used for flavouring food, as drinks and for making pickles. It is also placed on altars as offerings to spirits. The fresh fruits are used as a remedy for high blood pressure whereby three fresh fruits are taken each morning, the juice pressed out and drunk before breakfast. This is done for three days. The fruits are also salted. The salted fruits are mashed in water and taken as a remedy for coughs and sore throats. *Citrus medica* is also offered on altars, especially the variety with partially separated carpels forming finger-like projections, this fruit being called Buddha's hand. The fruit juice is also used as a remedy for high blood pressure, coughs and sore throats. *Citrus paradisi* is imported and sold in the Malaysian market but the grapefruit is generally not well accepted by the Malaysian population. Some varieties of this species are also planted at high elevations but the market is small as the locally planted varieties are inferior to the imported variety. *Citrus reticulata* is planted in the lowlands as well as highlands in Malaysia. There are a number of varieties but the quality is not very high and the market limited. Imported fruits are much more popular. The fruits are eaten fresh. They are also offered on altars. *Citrus sinensis* can only be grown at higher elevations in Malaysia and the market is also small. The imported fruits are much more popular.

Clausena excavata is a lowland shrub growing in open places, villages and forest edges. The plant has a strong foetid smell. Pounded leaves are applied externally for headache. Pounded leaves and roots are used as a remedy for ulcerated noses.

Euodia latifolia is a small tree growing in the lowland forests of Malaysia. *Euodia roxburghiana* is a medium sized tree in the lowlands and coasts, in primary and secondary forests and in peat swamps. Pounded leaves of both species are applied externally to bring down fever.

Feronia limonia is a small tree of Indian origin. In Malaysia it is planted and the fruits are used like that of *Aegle marmelos*.

Fortunella polyandra is mainly grown as an ornamental plant in Malaysia. They are either grown on the ground or as potted plants. Salted fruits are mashed and taken to treat coughs and sore throats.

Leaves and roots of *Glycosmis pentaphylla* and *Glycosmis puberula* are used in herbal mixtures given after childbirth. The two species are uncommon so the usage is limited. Herbal mixtures given after childbirth can contain more than 40 species of plants and the species lists vary from one traditional practitioner to another. For a particular practitioner also the list vary according to availability of plant materials.

Luvunga sarmentosa and *Luvunga scandens* are woody climbers in lowland and hill forests of Malaysia. The roots form part of herbal mixtures taken after childbirth. The roots of *Luvunga scandens* form part of a mixture of plants soaked in oil and then used by men to attract ladies.

Merrillia caloxylon is a small tree found in the lowland forests of Malaysia. Small pieces of wood is soaked in hot water and the infusion taken as a remedy for stomachache. The wood is scraped and the powder rubbed on the skin as a remedy for pains and aches.

Micromelum hirsutum and *Micromelum minutum* are shrubs or treelets found in the forests of Malaysia. Pounded leaves of either species is applied for fever and to counter swellings on the skin caused by contact with irritants such as caterpillar hairs and toxic plants.

Murraya koenigii is a small tree of Indian origin and planted in Malaysia for the leaves which are used for flavouring food. The young leaves are eaten raw as salad. *Murraya paniculata* grows wild in Malaysia, mainly on limestone hills. It is commonly cultivated as an ornamental plant. Pounded leaves is applied on the face to get rid of pimples. The leaves may be pounded with rice and dried to make face powder.

Paramignya scandens is a woody climber found in lowland forests. A decoction of the roots is drunk as a tonic that will improve a person's ability to withstand cold temperatures.

Ruta graveolens is a small herbaceous plant grown in pots as an ornamental. Planting this species is also believed to keep away evil spirits. Leaves and stems of this species is mixed with other plants and used to make medicated oil that is used for massaging aches and pains, headaches and stomachaches.

Zanthoxylum myriacanthum is a medium sized forest tree. Seeds of this species are burnt and the smoke inhaled to treat nose ulcers, including syphilitic nose ulcers.

The IUCN list of endemic plants of Peninsular Malaysia (1991) have 18 species for Rutaceae (see table 3 for the list of species). The IUCN list of non-endemic threatened plants of Peninsular Malaysia have 37 species for Rutaceae (see table 4 for the list of species). It is clear, therefore, that most of the native species of Rutaceae in Peninsular Malaysia are either endemic or non-endemic but are threatened.

The number of species combining the two IUCN lists gives a total of 55 species as endemic or threatened species of Peninsular Malaysia. As there are only about 60 species in Peninsular Malaysia (Stone, in Whitmore, 1972), nearly all the species of Rutaceae in Peninsular Malaysia are in the category of endemic or threatened. 17 of the 55 species are used for various purposes. This is nearly one third of the total.

Perry (1980) recorded about 50 species in Rutaceae as used medicinally in East and Southeast Asia. Of this total, 18 species are either endemic or non-endemic but threatened plants of Peninsular Malaysia. This is more than one third of the total. Bearing in mind that not all 50 species listed by Perry can be found growing in Peninsular Malaysia and therefore not in the IUCN lists referred to, the proportion of endemic or threatened species used medicinally must be even more when only local species are taken into account.

Table 3. The IUCN List of Endemic Plants of Peninsular Malaysia (1991). Uses for the species are added by the author.

No.	Species in Rutaceae	Uses
1	<i>Acronychia porteri</i> Hk. f.	Wood.
2	<i>Atalantia roxburghiana</i> Hook. f.	Medicine
3	<i>Euodia macrocarpa</i> King	
4	<i>E. pachyphylla</i> King	
5	<i>E. pilulifera</i> King	
6	<i>E. simplicifolia</i> Ridley	
7	<i>Fortunella polyandra</i> (Ridley) Tanaka.	Food, ornamental
8	<i>Glycosmis calicola</i> Stone	
9	<i>G. collina</i> Stone	
10	<i>G. crassifolia</i> Ridley	
11	<i>G. perakensis</i> Naray.	
12	<i>G. sapindoides</i> Lindley ex Wallich	
13	<i>Maclurodendron magnificum</i> T. Hartley	
14	<i>Melicope suberosa</i> Stone	
15	<i>Paramignya cuspidata</i> (Ridley) Swingle	
16	<i>P. lobata</i> Burkill	
17	<i>P. scandens</i> (Griff.) Craib	Medicine
18	<i>Tetractomia majus</i> Hook. f.	

Table 4. The IUCN List of Non-Endemic Threatened Plants of Peninsular Malaysia (1991). Uses of the species are added by the author.

No.	Species in Rutaceae	Uses
1	<i>Acronychia pedunculata</i> (L.) Miq.	Medicine, timber, charcoal, incense, fish poison.
2	<i>Atalantia monophylla</i> DC.	Medicine
3	<i>Burkillanthus malaccensis</i> (Ridley) Swingle	
4	<i>Citrus halimii</i> Stone	
5	<i>C. hystrix</i> DC.	Medicine, cooking, magic, wood.
6	<i>C. macroptera</i> Montr.	
7	<i>Clausena excavata</i> Burm. f.	Medicine, magic, wood.

Table 4. Continued.

8	<i>C. macrophylla</i> Hook. f.	
9	<i>Euodia euneura</i> (Miq.) Miq.	
10	<i>E. glabra</i> (Blume) Blume	Wood.
11	<i>E. latifolia</i> DC.	Medicine, resin, soap.
12	<i>E. robusta</i> Hook. f.	
13	<i>E. roxburghiana</i> (Cham.) Benth.	Medicine, magic, flavour.
14	<i>Glycosmis chlorosperma</i> (Blume) Spreng. var. <i>lindleyana</i> Stone	
15	<i>G. cyanocarpa</i> (Bl.) Spreng.	
16	<i>G. decipiens</i> Stone	
17	<i>G. mauritiana</i> (Lam.) Tanaka.	
18	<i>G. pentaphylla</i> (Retz.) DC.	Medicine
19	<i>G. puberula</i> Lindley	Medicine
20	<i>G. stenura</i> Stone	
21	<i>G. superba</i> Stone	
22	<i>G. tomentella</i> Ridley	
23	<i>G. trichanthera</i> Guillaumin	
24	<i>Luvunga crassifolia</i> (Roxb.) Buch.- Ham.	
25	<i>Maclurodendron porteri</i> Hook. f.	
26	<i>Merope angulata</i> (Willd.) Swingle	
27	<i>Merrillia caloxylon</i> (Ridley) Swingle	Medicine, wood.
28	<i>Micromelum hirsutum</i> Oliver	Medicine
29	<i>M. minutum</i> (Forst. f.) Wight & Arn.	Medicine
30	<i>Paramignya scandens</i> (Griff.) Craib ssp. <i>ridleyi</i> (Bur.) Swingle	Medicine
31	<i>Tetractomia tetrandrum</i> (Roxb.) Merr.	
32	<i>Tetradium glabrifolium</i> (Champ. ex Benth.) T. Hartley	
33	<i>T. sambucinum</i> (Blume) Hartley	
34	<i>Zanthoxylum acanthopodium</i> DC.	
35	<i>Z. myriacanthum</i> Wallich	Medicine, wood.
36	<i>Z. nitidum</i> (Roxb.) DC.	
37	<i>Z. rhetsa</i> (Roxb.) DC.	

Table 5. List of Rutaceae Species Recorded as Used Medicinally in East And Southeast Asia (Extracted from Perry, 1980). Status of the species is added by the author.

No.	Species/Status	Uses	Places
1	<i>Acronychia pedunculata</i> (L.) Miq. Threatened	Wounds, fractures. Rheumatism, scabies, colic.	China Indo-China
2	<i>Aegle marmelos</i> Correa	Digestion, laxative, dysentery, diarrhea, inflammation, TB, liver trouble, wounds, eruptions, prickly heat, sores, swellings, foot and mouth diseases, ophthalmia, heart palpitation.	India to Java
3	<i>Atalantia monophylla</i> DC. Threatened	Respiratory ailments	Indo-China, Peninsular Malaysia
4	<i>A. roxburghiana</i> Hook. f. Endemic	Respiratory ailments, stomachache.	Indo-China P. Malaysia
5	<i>A. simplicifolia</i> (Roxb.) Engl.	Respiratory ailments	Indo-China P. Malaysia
6	<i>Citrus aurantium</i> L.	Pimples, freckles. Diaphoretic, sedative. Hysteria, bronchitis, laxative, ringworm, gout, rheumatism, stimulant. Influenza.	China Indo-China Philippines Indonesia
7	<i>Citrus aurantifolia</i> (Christm.) Swingle	Headache, dysentery, gonorrhoea, stomachache. Cough, cold, dengue fever.	P. Malaysia Indonesia
8	<i>Citrus grandis</i> (L.) Osbeck	Stomachic, dyspepsia, vomiting, cholera, cold, itch, boils, hernia. Swellings, headache. Dysentery, stomachic. Sedative, fluxes.	China, P. Malaysia Indo-China Philippines
9	<i>Citrus hystrix</i> DC. Threatened	Stimulant	Indonesia
10	<i>Citrus limon</i> (L.) Burm. f.	Antidote for poison, tonic, stomachic.	Indo-China
11	<i>Citrus medica</i> L.	Bechic, lumbago, Asthma, febrifuge, anthelmintic. Vermifuge, stomachache	China, Indo-China P. Malaysia

Table 5. Continued.

12	<i>Citrus mitis</i> Blco	Itch, acne, pruritus, cough.	Philippines
13	<i>Clausena anisumolens</i>	Cough, fever, nausea, rheumatism, soporific.	Philippines
14	<i>Clausena excavata</i> Burm. f. Threatened	Stomach trouble Sudorific Tonic, astringent, emmenagogue Colic, headache, nose ulcers, post partum Fever, vermifuge	Myanmar Taiwan Indo-China P. Malaysia Indonesia
15	<i>Clausena lansium</i> (Lour.) Skeels	Stomachic, anthelminthic, rheumatism, enlarged spleen, diuretic, hernia. Dandruff, bronchitis	China Indo-China
16	<i>Clausena lenis</i> Drake	Bronchitis, furuncles	Indo-China
17	<i>Dictamnus dasycarpus</i> Turcz.	Jaundice, leprosy, headache, colds, rheumatism Bile disorders, visceral congestion, itches, boils, jaundice, emmenagogue, tonic, bechic, sedative, antipyretic	Korea China
18	<i>Euodia latifolia</i> DC. Threatened	Fever, cramps	P. Malaysia
19	<i>Euodia roxburgiana</i> (Cham.) Bent Threatened	Cold, rheumatism	P. Malaysia
20	<i>Euodia rutaecarpa</i> (Juss.) Hook.f. & Thomas	Stimulant, carminative Stomachic, anthelminthic, purgative, anodyne, nausea, diarrhea, dysentery, scurvy, dropsy, rheumatism, diuretic	China Japan
21	<i>Feronia limonia</i> (L.) Swingle	Stomachic, carminative, bilious, tonic, nausea	Myanmar Indo-China
22	<i>Fortunella japonica</i> (Thunb.) Swingle	Stimulant, carminative, antiphlogistic, antivenous, deodorising Pulmonary affections	China Indo-China
23	<i>Glycosmis pentaphylla</i> (Retz.) Correa Threatened	Coughs, bruises Post partum, aperient Inflammation, itch Bilious, intestinal trouble	China, Indo-China P. Malaysia Indonesia

Table 5. Continued.

24	<i>Glycosmis puberula</i> Lindl. Threatened	Post partum, nausea	P. Malaysia
25	<i>Lunasia amara</i> Blco.	Swellings, skin diseases Snake bites, stomach trouble	Indonesia Philippines
26	<i>Luvunga sarmentosa</i> (Bl.) Kurz.	Toothache, rheumatism	P. Malaysia
27	<i>Luvunga scandens</i> (Roxb.) Buch.-Ham.	Post partum	P. Malaysia
28	<i>Micromelum compressum</i> (Blco.) Merr.	Headache, stomachache Carminative, diarrhea, toothache, febrifuge, convulsions	Philippines
29	<i>Micromelum falcatum</i> (Lour.) Tan	Emmenagogue, sores, insect bites, itch, fever	Indo-China
30	<i>Micromelum hirsutum</i> Oliv. Threatened	Itch, fever Post partum, vertigo, fever, insect rash, skin diseases, gout	Indo-China P. Malaysia
31	<i>Micromelum minutum</i> (Forst. f.) W.&A. Threatened	Scabies, emmenagogue Ague Headache	Indo-China P. Malaysia Philippines
32	<i>Micromelum pubescens</i> Bl.	Scabies, emmenagogue Ague Headache	Indo-China P. Malaysia Philippines
33	<i>Murraya paniculata</i> (L.) Jack	Stomachache, dysentery, bruises, swellings, itch Dysentery, fever Tonic, toothache Emmenagogue, herpes, tapeworm, diarrhea, dysentery Stimulant, toothache, Venereal diseases	China Indo-China P. Malaysia Philippines Indonesia
34	<i>Paramignya scandens</i> (Griff.) Craib Threatened Endemic	Post partum, abdominal complaints, syphilis	P. Malaysia
35	<i>Poncirus trifoliata</i> (L.) Rafin	Digestive, eczema, fever Stomachic, diarrhea, antiemetic, stimulant, diuretic, rheumatism	Korea China
36	<i>Ruta angustifolia</i> (L.) Pers.	Antidote for poisons Tetanus, syncope, dropsy, neuralgia, earache,	China Indo-China

Table 5. Continued.

37	<i>Ruta chalepensis</i> L.	rheumatism, spasm, emmenagogue,	
38	<i>Ruta graveolens</i> L.	sudorific, anthelmintic, itch Convulsions, jaundice	Indonesia
39	<i>Severinia buxifolia</i> (Poir.) Ten.	Carbuncles, bechic, malaria Respiratory ailments	Taiwan Indo-China
40	<i>Toddalia asiatica</i> (L.) Lamk.	Tonic Bowel complaints, rheumatism Pulmonary disorders Tonic, febrifuge Diarrhea, fevers, stomach disorders	Myanmar Taiwan Indo-China Indonesia Philippines
41	<i>Triphasia trifolia</i> (Burm. f.) P. Wils.	Respiratory diseases Bowel complaints, tonic, expectorant	Indo-China Philippines Indonesia
42	<i>Zanthoxylum</i> <i>acanthopodium</i> DC. Threatened	Sudorific, antipyretic	Indo-China
43	<i>Zanthoxylum ailan-</i> <i>thoides</i> Sieb. & Zucc.	Chills, influenza, indigestion, diarrhea, sunstroke, stimulant	China
44	<i>Zanthoxylum armatum</i> DC.	Anthelmintic, stimulant, dental diseases, scabies, snake bites, stomachic	China, Taiwan, Indo-China
45	<i>Zanthoxylum</i> <i>myriacanthum</i> Wall. ex Hook. Threatened	Syphilitic nose ulcers	P. Malaysia
46	<i>Zanthoxylum nitidum</i> (Roxb.) DC. Threatened	Sunstroke, cholera, anthelmintic, scrofula, contusions, snake bites Disinfectant, bechic, swellings Anthelmintic, carminative, stimulant, diaphoretic, antipyretic, catarrh, rheumatism, uterine hemorrhage, lumbago, dropsy, colic, fever, emmenagogue	China Taiwan Indo-China
47	<i>Zanthoxylum rhetsa</i> (Roxb.) DC. Threatened	Tonic, febrifuge	Indo-China

General Discussion and Conclusions

Planted species of Rutaceae are mainly used as sources of fruits, as ornamentals, for flavouring food or medicine. Wild species are not sources of edible fruits but are mainly used as medicine or wood.

More than one third of the total number of endemic and non-endemic but threatened species of Rutaceae in Peninsular Malaysia are used for traditional purposes. While deforestation is the major cause of lost in biodiversity, pressure on species survival from traditional uses cannot be overlooked. Firstly, while many species may not be recorded as used, ethnobotanical records in Peninsular Malaysia faced a big gap between the time of Burkill in the early 1930s until quite recently. Although there is a surge of scientific interest in Ethnobotany in recent years, many species used by rural and remote communities are as yet to be recorded. Secondly, while existing records show that many species are not used, related species in the same genus are used. For example, there are numerous species of *Euodia*, *Glycosmis*, *Paramignya*, and *Zanthoxylum* in the two IUCN lists but only a small number of species from each genus is recorded as being used. The differences between species within each genus may not be appreciated by local users and therefore one species can be substituted for another. Even when differences between species are obvious to the locals, in many cases they note the similarities and relate one species to the next and subject the plants to similar ethnobotanical uses. This has been observed in ethnobotanical studies among the Orang Asli as well as Malay communities, especially in traditional medicine, not only in the case of *Citrus* and their relatives, but also for other plants as well. When plants are used only within the community that collected them there is little threat to plant survival but commercialisation of traditional medicine adds extra pressure on many local species. This paper does not seek to place the traditional users of plants in the Rutaceae family in bad light but to point out the importance of conservation in this family and all other plant species used in traditional medicine while we continue to record plant utilisation by various communities and learn not only of how plants are used traditionally and can be used commercially but also how to ensure that the rich plant genetic resource in Malaysia is not depleted.

We at the University of Malaya have combined the study of traditional uses of plants with plant conservation. The university authorities have set aside a piece of land approximately 82 hectares in area as a botanic garden which is called "Rimba Ilmu" which means forest of knowledge. Collection and planting in this botanic garden began slightly more than 20 years ago. At that time the area allocated was 40 hectares. Rutaceae germplasm collection is one of the thrust areas of our botanic garden and the garden is now recognised by the IBPGR (International Board for Plant Genetic Resources) as the center of *Citrus* and Citroid collection for South-East Asia. The botanic garden also has a large collection of medicinal plants. Other plants collected and planted in the garden are fruits and their relatives, palms, wild orchids, gingers and their relatives, timber trees, rattan, wetland plants

and potential ornamental plants. Thus in studying present and potential uses of plants, we also ensure that the plants that we study are conserved and continue to be available.

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Literature Cited

- Burkill, I.H. 1966. A Dictionary of the Economic Products of the Malay Peninsula. Govt. Printing Office.
- IUCN. 1991. The IUCN List of Endemic Plants of Peninsular Malaysia. IUCN Conservation Monitoring Centre, Kew, U.K.
- IUCN. 1991. The IUCN List of Non-Endemic Threatened Plants of Peninsular Malaysia. IUCN Conservation Monitoring Centre, Kew, U.K.
- Perry, L.M. 1980. Medicinal Plants of East and Southeast Asia. The MIT Press. USA.
- Sahadevan, N. 1987. Green Fingers. Sahadevan Publications, Malaysia.
- Whitmore, T.C. 1972. Tree Flora of Malaya. Vol. 1. A manual for Foresters. Longman. Malaysia.