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THE VEGETATION OF TARUTAO NATIONAL PARK

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ABSTRACT

The 51 islands of Tarutao National Park lie off the extreme southwest coast of peninsular Thailand in the Andaman Sea. The vegetation of these islands is described and 869 vascular plant species known from the Park are enumerated. Particular attention is given to the nature of the flora of Tarutao Island as compared with the flora of the Adang Islands. Floristic differences between the island groups appear to be caused primarily by differences in soils and topography rather than by the Adang group having a fundamentally Malayan affinity, an assertion made by H.N. Ridley, author of the *Flora of the Malay Peninsula*.

INTRODUCTION

I first went to Tarutao National Park in February 1979. At that time I was collecting plants for the herbarium at Prince of Songkhla University in Haad Yai. Dr. Tem Smitinand, of the Forest Herbarium, Royal Forest Department, suggested that Tarutao National Park would be a good collecting locality, as little botanical work had been done in the Park and some rare and unusual plants were likely to occur there. After a week on Tarutao Island I already began formulating plans to return. Tarutao proved to be a place of great beauty with relatively undisturbed rain forests, mangrove swamps, littoral vegetation, and forests over limestone.

H.N. RIDLEY, in the *Flora of the Malay Peninsula* (1922), briefly discussed the flora of Tarutao (p. XI) :

> The northern portion (of the Malay Peninsula) from the above-mentioned boundary line (7 degrees north) southwards to the mouth of the Kedah River, including the islands of Langkawi and Terutau, possesses a very distinct flora, having close relations with that of the Siamese territory south of Tenasserim and Mergui, upwards of forty genera being represented in this area which are unknown south of this line, while more than sixty genera well represented in the south part of the peninsula are missing.

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> The Pulau Adang group of islands, lying west of Terutau, however, contains more features of the southern flora and but little of the northern.

That seems odd. Why would the Adang Islands, only 45 km away from Tarutao and Langkawi, have a different flora ? If Ridley was right that the Adang flora is more Malesian in character and the Tarutao flora more Siamese, what are the reasons for this ?

This phytogeographic problem spurred my interest in Tarutao and when Mr. Boonruang Saisorn, Chief of Tarutao National Park, asked me if I would be willing to do more botanical work at Tarutao, I readily agreed. A grant to the National Park Division from the Asia Foundation enabled me to work in the Park from October 1979 until September 1980.

I went to Tarutao with two primary aims: to investigate Ridley's assertion about the nature of the Tarutao and Adang floras, and to provide the National Park Division with basic information about the vegetation there. Usually these two goals complemented each other and I discuss my findings about both in this paper.

Quite unexpectedly I stayed at Tarutao an additional seven months (through April 1981) to direct a marine turtle conservation programme for the International Union for the Conservation of Nature and Natural Resources (IUCN) and the World Wildlife Fund (WWF). During this time I made some additional botanical collections and observations.

Location and Physical Features

The 51 islands of Tarutao National Park are located in the Andaman Sea off the west coast of peninsular Thailand between 6° 30′ N and 6° 44′ N latitude and 99° 44′ E and 99° 9′ E longitude. Park boundaries encompass about 1500 km^2 of land and sea. Of the 51 islands, only three have areas larger than 10 km^2 : Tarutao (151 km^2), Rawi (31 km^2), and Adang (30 km^2).

Tarutao lies approximately 26 km off the mainland. Malaysia's Langkawi Island lies 10 km due south of the southernmost tip of Tarutao. Tarutao is 26 km long and 11 km across at the widest point. Mountain ranges running north to south dominate the topography of the island. The highest portions of the ranges rise to over 600 m, the highest point on the island being 708 m above sea level. Between these ranges are low valleys where streams flow throughout the year. The west coast is characterized by long sandy beaches, mangrove swamps, and densely forested hillsides descending to the sea. The east coast consists of craggy limestone rocks, small islands, and scattered small pockets of mangrove swamp.

Figure 1. Map of Thailand showing the location of Tarutao National Park

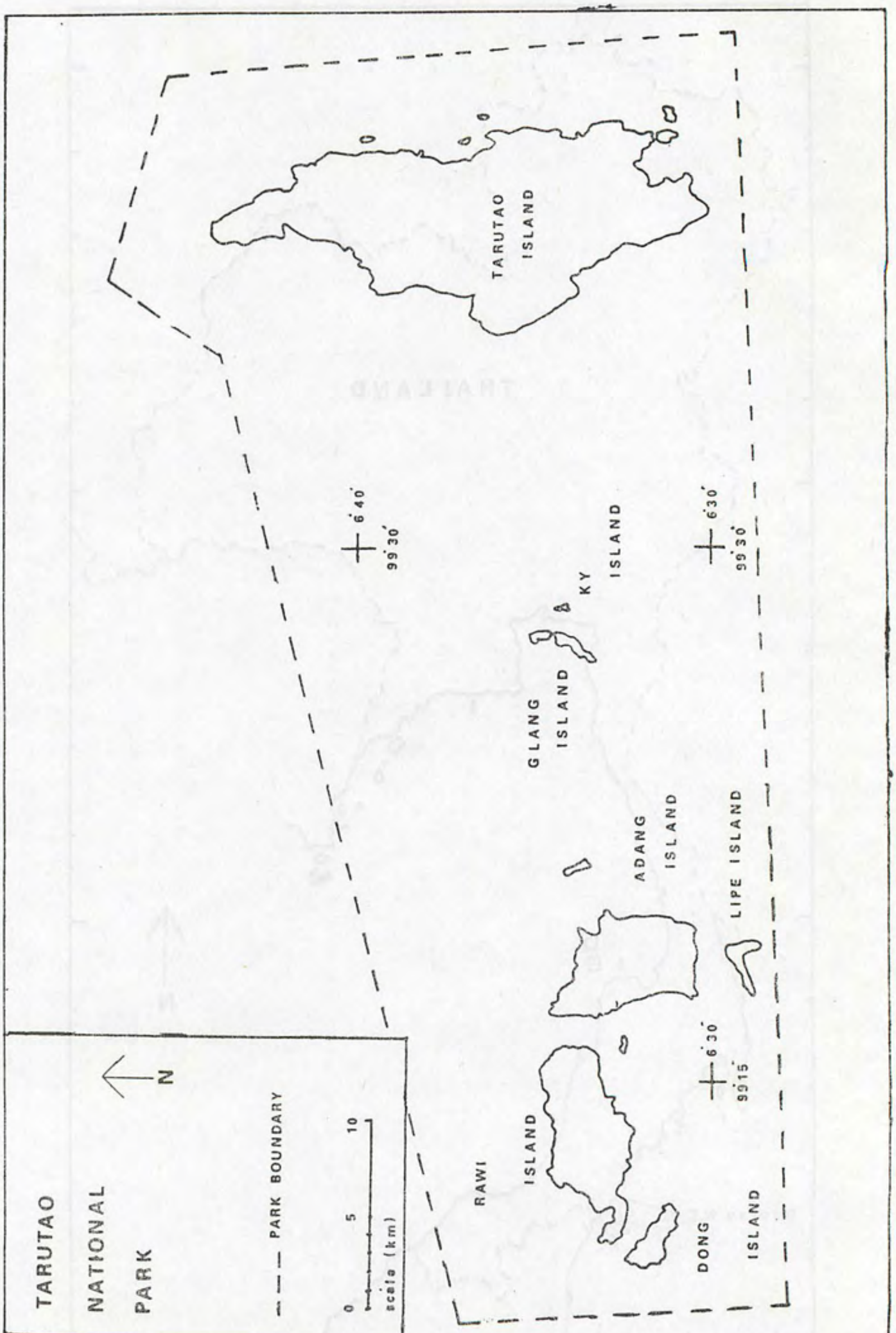

Figure 2. Map of Tarutao National Park, Satun, Thailand.

The rocks on Tarutao are of two types : the sandstone facies of the Tarutao Formation and the limestone facies of the Thung Song Formation (TERAOKA *et al.*, 1982). The sandstones and siltstones of the Tarutao Formation cover about 65 percent of the island. These upper Cambrian rocks are some of the oldest in Thailand and have long interested geologists. The Machinchang Formation of Malaysia (including part of Langkawi) correlates with the Tarutao Formation (TERAOKA *et al.*, 1982).

The northern and eastern portions of Tarutao, approximately 30 percent of the land area, consist of lower Ordivician limestone rocks of the Thung Song Formation. Similar rocks are found in the northernmost part of Kedah State in Malaysia and in peninsular Thailand up to the vicinity of the town of Thung Song (Fig. 4). The limestones on Langkawi are younger (Middle Ordovician to Silurian), and are considered part of the Setul Formation (TERAOKA *et al.*, 1982).

Erosive forces have carved the Tarutao limestone into some fantastic configurations. Islands off the southern tip and east coast of Tarutao are towering pinnacles with sheer vertical cliffs descending into the sea. At the northern end of Tarutao there is a huge limesttone sinkhole which is filled with seawater that passes through a limestone cave. The rocks there are sculptured into razor-like forms, making walking difficult and hazardous.

Quaternary alluvia fill the broad valleys behind Chak Bay, Son Bay, Talo Udang Bay, and where a number of small streams enter the sea.

Adang and Rawi, located about 45 km west of Tarutao, are steep, rugged islands composed of Triassic granite and a small amount of Quaternary alluvia. The highest point on Adang Island is 703 m above sea level, on Rawi, 463 m above sea level. Very little flat land exists on Adang; usually the rocky hillsides slope directly into the sea. Rawi is less rugged and possesses some flat land and a number of gently sloping hillsides.

No limestone occurs in the Adang group and no granite on Tarutao; there are no geologic formations common to both islands. Granite rocks do occur on Langkawi however.

Climate

Tarutao National Park is subject to a tropical monsoon climate characterized by westerly winds and high rainfall from the southwest monsoon from May through October. Rainfall averages over 200 mm per month for those six months and amounts to over 70 percent of the average annual total of 2663 mm (Table 1).

Table 1. Mean monthly rainfall, relative humidity, and temperature of Tarutao National Park (estimated). Rainfall and relative humidity data from Satun (1931–1970). Temperature data from Phuket (1951–1975). Data from MAHIDOL UNIVERSITY (1977).

Month	Rainfall mm	Rainfall No. days	Relative humidity (%)	Temperature (°C)
J	47.1	5.9	75.0	26.9
F	33.9	4.8	72.5	27.7
M	88.9	7.0	77.5	28.4
A	179.1	12.3	77.5	28.4
M	263.9	22.1	82.5	26.9
J	363.1	20.2	82.5	27.9
J	344.6	19.9	85.0	27.6
A	275.5	20.1	82.5	27.9
S	318.2	22.9	82.5	27.0
O	339.7	23.2	82.5	26.8
N	257.9	15.9	82.5	26.6
D	102.3	9.4	80.4	26.6
	2614.2	183.7 (totals)	80.2 (average)	27.5 (average)

Table 2. Annual rainfall, number of rainy days per year, and Q values for same stations in peninsular Thailand. Data from the Department of Meteorology, Bangkok, Thailand.

Location	Annual raiufall (mm)	Rainy days	Q	Years of data
Narathiwat	2611	170	31.6	1951–1980
Pattani	1796	146	63.2	1964–1980
Songkhla	2094	158	53.2	1951–1980
Trang	2327	174	40.6	1952–1980
Phuket Airport	2617	183	29.8	1952–1980

From November through April easterly winds prevail; most of the moisture they carry falls as rain on the eastern side of peninsular Thailand. December, January, February and March are normally very dry months at Tarutao. In January 1980 and 1981 no measurable amount of rain fell.

Relative humidity and temperature vary seasonally, but not to the extent that rainfall does.

History of Botanical Work in Tarutao National Park

Botanical work in what is now Tarutao National Park probably commenced with Charles Curtis, Superintendent of Gardens and Forests at Penang around the turn of the century. Curtis visited Langkawi for the first time in 1898 and several times thereafter. Tarutao was then considered part of the Langkawi Islands, and a trip to Langkawi often included a visit to Tarutao as well.

Mohamed Haniff from the Waterfall Gardens at Penang visited Langkawi in 1900, 1906, 1911, 1914, and 1921. On at least one of those trips, Mohamed Nur bin Mohamed Ghose, another Malaysian collector, accompanied Haniff to Tarutao.

H.C. Robinson (1917), an ornithologist who served as Director of the Federated Malay States Museum in Kuala Lumpur, visited Tarutao (1907, 1917) and Adang (1911, 1917) at least twice. Although primarily interested in birds, Robinson also collected a few plants.

H.N. Ridley, then Director of Botanic Gardens, Singapore, visited the Adang Islands for three days in April 1911. Ridley (1912, p. 45) wrote, "The flora of this outlying group (the Adang Islands) had never been investigated and I was glad of the opportunity afforded me by Mr. Robinson to accompany him there in the 'Seabelle' in April." Ridley collected on Adang, Rawi, Lipe, and on Butong (now called Dong). On the way back to Langkawi he made a few collections at Tengah (now called Glang) Island.

A.F.G. Kerr, of the Botanical Section, Ministry of Commerce, Bangkok, collected on Tarutao, Adang, Rawi and Dong Islands from January 10-20, 1928. He collected 266 numbers, nearly 200 from the Adang group (Jacobs, 1962). According to Jacobs there is an account of Kerr's trip to Tarutao in one issue of *The Record*, a publication of the Ministry of Commerce in Bangkok. I was unable to locate this publication.

The persons mentioned above are the only early collectors I am certain visited what is now Tarutao National Park. Quite likely, F.W. Foxworthy, M.R. Henderson, and some of the other botanists who collected on Langkawi also made at least brief excursions to the southern tip of Tarutao.

From 1939 to 1946 the Thai government exiled common criminals and political prisoners to Tarutao. Over 2000 persons died on the island. It later became a pirate's lair from which merchant ships plying the waters of the Andaman Sea were terrorized. After these events Tarutao became an infamous, best-forgotten place visited by few persons.

In the last 30 years only a handful of botanists have visited Tarutao and only for brief periods. Dr. Tem Smitinand has visited Tarutao and Adang more times than anyone else but his collections are few. Members of the Fifth Thai-Danish Expedition (1966) stopped at Tarutao for a few days. They made 56 collections of orchids and 70 collections of other families. Unfortunately the names of the species collected were never published (SEIDENFADEN *et al.*, 1968).

In 1974 Tarutao and the Adang Islands were declared a national park. Shortly thereafter, a team of students and staff from the Environmental Management Programme at Mahidol University surveyed the geological and biological resources of the park to provide a data base for ecodevelopment. Although none of the team members were botanists, they produced an excellent outline of the vegetation there. They did this by analyzing aerial photos and making spot checks in the field, Floristically their work is not very detailed, but it does provide a great deal of information about the nature, structure, and extent of forest types. This information is recorded (in Thai) in the *Report of Second Survey of Tarutao National Marine Park*, MAHIDOL UNIVERSITY, BANGKOK, 1977.

When I went to Tarutao in 1979, it was not exactly a botanical terra incognita, but it was far from being well known. Fortunately RIDLEY (1922) included Tarutao and the Adang Islands in his *Flora of the Malay Peninsula*. In that work over 150 of Ridley's, Robinson's' Curtis', and Haniff and Nur's collections are included. RIDLEY (1912) listed over 160 plant species (including ferns) which he collected from the Adang Islands. Most of these were later included in his *Flora of the Malay Peninsula*.

Kerr's collections are recorded in the *Florae Siamensis Enumeratio* (see CRAIB in the References). This work is only complete as far as part of the Scrophulariaceae, thus many of Kerr's Tarutao and Adang collections are not included, but just over 100 species from Tarutao and Adang are listed.

THE FLORA: BACKGROUND

Botanists working in Malaya soon learned that there was a great difference between the flora of the southern portion of the Malay Peninsula and the Thai portions of Peninsula south of Burma. In 1910 Ridley explored the northern portions of Malaya (Kedah and Perlis) and the southern Thai provinces, especially Satun, to try to determine where the boundary line between the Thai-type and Malayan-type forests lay. RIDLEY (1911) observed that north of Alor Star more than 60 Malayan genera disappear and thus concluded that a line drawn across the Peninsula at Alor Star marks the northern limit of the Malayan flora. He attempted to explain this difference by noting a climatic change characterized by a distinct dry season. He also observed that the rocks of the south of the Peninsula consist primarily of limestone and sandstone.

RIDLEY (1911) also suggested that the Malay Peninsula south of Kedah Peak (Gunong Jerai) was once an island separated from the northern portions of the Peninsula by a shallow sea. He hypothesized that the taller mountains of the region were islands. Subsequent denudation of the sandstone mountains north of Alor Star filled in the shallow seas. This separation accounted for the abrupt change in the flora north of Alor Star.

According to RIDLEY the sea did not entirely isolate the two floras. Limestone outcrops which extended down into Malaya continued to support a typically Thai flora. For an example he noted that the top of the limestone Batu Caves near Kuala Lumpur supported a flora with many Thai elements. Going in a northerly direction RIDLEY envisioned that granite mountains, some of which were islands, continued to support a typically Malayan flora. He noted the affinity of the floras on the granite hills of Penang, Gunong Jerai, the Pulau Song Song group, and Gunong Raya on Langkawi.

After visiting the Adang Islands, RIDLEY (1912, p. 48) wrote:

> The most noticeable part about the flora as a whole was its difference from that of the Langkawi Islands, especially in the preponderance of Malayan as opposed to southern Siamese plants. Naturally the two groups of islands being so near, there were a number of plants characteristic of the south Siamese flora as laid down in a previous paper, but there were also a number of Malay Peninsula forms, such as *Agelea, Urophyllum, Lasianthus,* some of the Dipterocarpaceae and Anonaceae, etc. The flora suggests rather an affinity with the Pulau Song Song group of islands off the Kedah coast which contains nothing or little of the south Siamese flora. It seems too to have relations with the Andaman Islands which are not at all connected with the south Siamese plants but have a Malayan flora.

Although RIDLEY did not invoke the granitic composition of the Adang group as a reason why its flora differs from Tarutao and Langkawi, this would certainly fit in with the rest of his theory about the nature and origin of the flora of northern Malaya and southern Thailand. When RIDLEY noted the difference from Langkawi, it was not clear whether he referred to the limestone on Langkawi or the granite, because in his 1921 paper he wrote that the flora of Gunong Raya had affinities with the typically Malayan flora on Penang and other granite mountains to the south.

BODEN KLOSS (1920) suggested that the northern boundary of the Malayan flora is a line joining Alor Star and Singorra (now called Songkhla). He, too, thought that this boundary was once the coast line of an island that is now the Malay Peninsula. KLOSS described the transition in forest types that takes place further up the Peninsula near the Kra Isthmus. He believed that the forests north of the Alor Star line and south of the Kra Isthmus constituted a true intermediate vegetation of elements from north and south.

FOXWORTHY (1930), studying the distribution of commercial timber trees, reached essentially the same conclusion as KLOSS (1920), except that Foxworthy thought that the Malayan-type forests stopped just north of Pattani at Khok Pho. He also commented that the forests of Langkawi were more related to those of peninsular Thailand than to the Malayan forests.

By 1937 when RIDLEY published the "Origin of the Flora of the Malay Peninsula", his views regarding the Thai-Malayan forest transition had been modified somewhat. He wrote that the northern limit of the Malayan flora is a line running just north of Kedah Peak to Kota Bahru and that this corresponds with the termination of the granitic mountains. He still maintained that the Peninsula was once an island, but suggested that the separation occurred at the Kra Isthmus.

C.G.G.J. VAN STEENIS (1950) confirmed the significance of the Alor Star-Songkhla Line, noting that 375 Malesian genera reach their northern limit there while 200 northern Asiatic genera reach their southern limit. The Alor Star-Songkhla Line is one of the main "demarcation knots" defining the limits of the Malesian flora.

WHITMORE (1975) summarized this information, incorporated more recent observations, and concluded that the northern limit of the Malayan flora is best demarcated by a line drawn from Kangar on the west coast of Malaysia to Pattani in southern Thailand. This line passes through the southern part of Langkawi (Fig. 3). WHITMORE relied primarily on the distribution of species of *Shorea* to determine that phytogeographic boundary. The Malayan-type forest is characterized by the Red Meranti group of *Shorea*. *Shorea curtisii*, a ridge-top species, is a common member of this group. *Balanocarpus heimii*, and the palms *Eugeissonia tristis*, *Iguanura*, *Nenga*, and *Pinanga*, are also characteristic Malayan species.

In Thai-type forests the Red Meranti group of *Shorea* is generally replaced by the White Meranti group, especially *Shorea hypochrea*. *Parashorea stellata*, *Anisoptera oblonga*, *Dipterocarpus kerrii*, *Shorea guiso*, *Intsia palembanica* and *Sindora* spp. are also characteristic of the Thai-type forests.

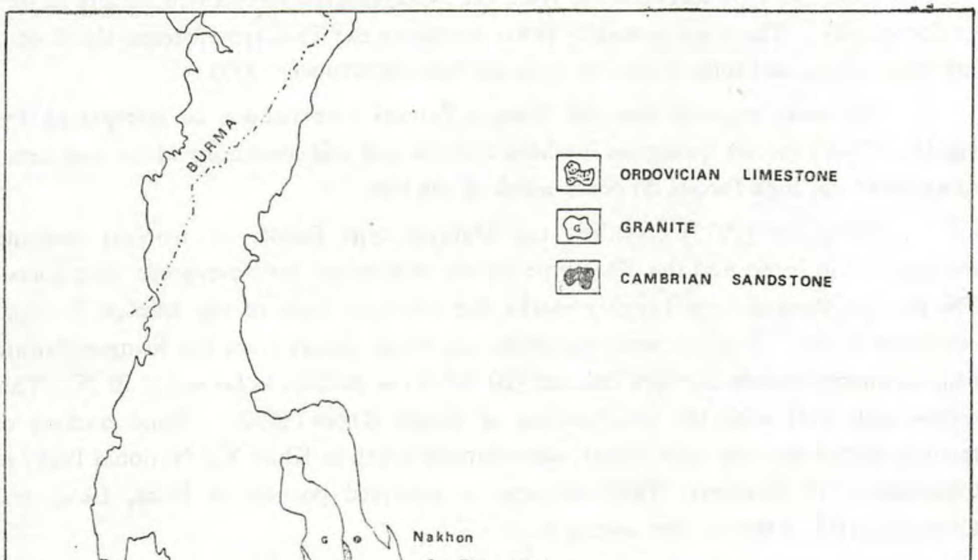

Figure 3. Some geological formations in the Malay Peninsula and the Kangar-Pattani Line

The Thai-type forests differ from the Malayan-type forests structurally as well as floristically. There are generally fewer species in the Thai-type forests, the forests are not as high, and huge emergent trees are rare (WHITMORE, 1975).

WHITMORE stressed that the Kangar-Pattani Line cannot be interpreted too rigidly. Some species transgress it where climatic and soil conditions allow and areas of species-rich, high forests do occur north of the line.

WHITMORE (1975) classified the Malayan-type forests as tropical lowland evergreen rain forest and the Thai-type forests as tropical semi-evergreen rain forest. The Kangar-Pattani Line roughly marks the northern limit of the tropical lowland evergreen forest. Tropical semi-evergreen rain forest occurs from the Kangar-Pattani Line to approximately the Kra Isthmus (10° 50′ N) or perhaps as far as 12° 50′ N. This corresponds well with the observations of BODEN KLOSS (1920). Some pockets of tropical semi-evergreen rain forest occur farther north in Khao Yai National Park, at Chanthaburi in Southeast Thailand, and in scattered pockets in India, Laos, and Cambodia (P.S. ASHTON, pers. comm.).

The term 'semi-evergreen' when applied to the forests in the southernmost part of peninsular Thailand is best thought of as a classification rather than as a rigidly applicable description. Although a few of the canopy trees may lose their leaves for short periods in the dry season, the forest as a whole always appears green.

RIDLEY (1911, 1922, 1937) cited climate, the change from granitic to sandstone rocks, and possibly isolation caused by the sea as the causes for the change from tropical lowland evergreen forest to tropical semi-evergreen forest. WHITMORE (1975) emphasized the effect of climate on the distribution of forest types. He mapped rainfall types for the Malay Peninsula on the basis of the average number of dry months per year and the average number of wet months per year. Any month with over 100 mm of rain is considered wet; a month with less than 60 mm of rain is considered dry. WHITMORE calculated a figure Q, where Q equals (dry months/wet months) $\times$ 100. He defined four rainfall types according to the value of Q: A ($Q = 0 - 14.3$), B ($Q = 14.3$–33.3), C ($Q = 33.3$–100), and D ($Q = 100$–300). (Note, I have slightly simplified WHITMORE's system.) The Malay Peninsula north to approximately the Kangar-Pattani Line has a type A climate, one in which there is little or no seasonal water shortage. North of the Kangar-Pattani Line to about the Kra Isthmus a type B climate prevails, one in which there may by two or three dry months per year (monsoon climate).

The correlation between forest types and rainfall types in WHITMORE (1975) is extraordinarily good. In practice things are not so simple. I obtained rainfall data from the Thai Department of Meteorology and calculated the value of Q for Narathiwat, Pattani, Songkhla, Trang, and Phuket Airport. The values I obtained were surprisingly high for all stations and differed considerably from those in WHITMORE (1975) (Table 2). Most climatological maps show that Narathiwat, Pattani, and Songkhla have no or very few dry months and should be type A climates sensu Whitmore. The data I obtained indicate that all three of these stations have a marked dry season and that Narathiwat ($Q = 31.6$) has a type B climate, while Pattani ($Q = 63.2$) and Songkhla ($Q = 53.2$) have type C climates. Trang ($Q = 40.6$) has a type C climate and Phuket Airport ($Q = 29.8$) has a type B climate. All calculations, except those for Pattani, are based on at least 29 years of data. Irregularities occur in the data for Pattani and it may not be reliable. I have no pertinent data for Satun or Tarutao, but a type B or C climate is likely.

Most surprising about these figures are the high values of Q for Narathiwat, Songkhla, and Pattani. Evidently some of the typical Malesian floristic elements such as the Red Meranti group of *Shorea* can exist in climates with at least a couple of dry months per year. Also the climate of Narathiwat apparently does not differ significantly from that of Phuket Airport, and apparently from Satun and Tarutao, yet the difference in forest types is well documented.

Another possibility is that the climate has changed. Extensive forest clearing in peninsular Thailand, especially along the east coast in the Pattani-Narathiwat region, may have created a drier climate, at least near the towns where the rainfall is measured. This has happened in other parts of Thailand (TEM SMITINAND, pers. comm.).

Perhaps factors other than rainfall alone should be considered in an attempt to explain the distribution of forest types. As far as I know, geologists today do not think there was a marine transgression across the Malay Peninsula near Alor Star as Ridley suggested. If any transgression occurred, it was further north, along the Phangnga-Surat Thani fault (FOODEN, 1975).

RIDLEY (1937) believed that the granitic mountains terminated north of Alor Star and that this also explained the change in the flora. This is only partially true. Certainly the extensive granite mountains of the Main Range in Malaya terminate, but some granite mountains do occur north into Thailand. Fairly extensive granite outcrops occur near Narathiwat and Pattani. Further research on the northern limits of the Malayan-type forest and its relation to rocks and soils is needed before we can determine if the distribution of granitic rocks is, as RIDLEY maintained, a key to understanding the floristic differences across the Kangar-Pattani Line (Figure 3).

With this background information we can now consider the situation at Tarutao and Adang. Rainfall type B or C and the presence of sandstone and limestone rocks lead us to predict that the vegetation on Tarutao should be tropical semi-evergreen rain forest on the sandstone portions of the island and a drier type on the limestone. This would make it typically Thai and accord well with RIDLEY'S observation. On Adang a type B or C climate occurs. Although Adang is 45 km farther out at sea than Tarutao, preliminary observations indicate that there is no significant difference in rainfall. The granitic composition of the Adang group is the most important difference from Tarutao and, as just mentioned, this may affect the distribution of forest types. RIDLEY stressed this factor; later workers have downplayed it. If significant differences in the floras of Tarutao and Adang are found, perhaps the reasons can be discovered. Information of this sort would contribute to our understanding of floristic differences across the Kangar-Pattani Line.

To compare the floras of Adang and Tarutao and make qualitative judgements about their affinities, the criteria employed on the mainland should be used: floristics and structure. In particular, the presence or absence of indicator species such as the members of the Red and White Meranti groups of *Shorea* and the shade-loving forest palms, *Iguanura, Nenga, Eugeissonia,* and *Pinanga.* RIDLEY (1911) lists some of the Malayan genera not found north of Alor Star. The presence of some of these on Adang would indicate a Malayan affinity. The affinities of the Adang and Tarutao floras are considered in the discussion section of this paper.

ACTIVITIES AND METHODS

From October 1979 to August 1980 I made fairly frequent collecting trips to as many places in the park as possible. Park protection stations at Phante Bay, Talo Udang Bay, and at Adang Island served as bases for my collecting activities. Consequently the vicinities near these stations were frequently botanized. Collecting activities in other parts of the park were limited by a lack of means of access and shelter. The interior forests of Tarutao, mountaintops of all the islands, and the forests of Rawi Island were all undercollected.

My identifications are usually based on flowering and/or fruiting specimens. Because I covered such a wide area at irregular intervals, it was usually not possible for me to return to individual plants to collect fruits after I had collected flowers. Consequently some of my specimens have been difficult to identify to species. Once I could recognize a species, I tried to record its distribution and what other plants were associated with it. I did not collect common, easily recognized species such as *Terminalia catappa*, but have included these in the species list.

Altogether I collected nearly 1300 numbers. The most complete sets of specimens are now at the Forest Herbarium in Bangkok and at Harvard's Arnold Arboretum in Cambridge, Massachusetts. Incomplete sets exist at Prince of Songkhla University in Haad Yai and at Aarhus in Denmark.

ENUMERATION

Gymnosperms and angiosperms are listed alphabetically by family and then by genera and species in Appendix 1. The main group of pteridophytes, the ferns, are listed alphabetically by genus and species. This was done because of the different conceptions about the delimitation of fern families.

After angiosperm species there usually occurs a letter followed by three numbers. The letter indicates the habit of the plant (see key). The first number indicates the habitat the plant is usually found in (see key), and follows those used for vegetation types in the next section. The second number indicates when the plant was known to be in flower; sometimes two numbers are hyphenated to indicate a several-month period. The third number tells when the plant was known to be in fruit. If no specific information is available, this number is omitted. If the time of fruiting is known, but not the time of flowering, a question mark appears in place of flowering time. Numbers in parentheses indicate less common habitats or flowering or fruiting times than the first number given. The numbers 1-12 correspond to the months of the year.

As an example of how to read the species list, note *Buchanania arborescens* in the family Anacardiaceae. First the species name and naming authority are listed. Then "T" indicates that the species is a tree, "5" indicates Barringtonia formation, "(9)" means that it also sometimes occurs in semi-evergreen forest, "2" indicates flowering in February, and "3" indicates fruit in March.

The five columns on the right side of the species lists indicate the islands on which the plants were collected or observed: T (Tarutao), A (Adang), R (Rawi), D (Dong; formerly called Butong), G (Glang; formerly called Tengah). The letters in the columns stand for the source: C (Congdon), R (Ridley), K (Kerr). The information from RIDLEY comes from his 1912 paper "A botanical excursion to Pulau Adang" and from *The Flora of the Malav Peninsula* (1922). Information attributed to KERR comes from *Florae Siamensis Enumeratio* (CRAIB, 1925–1939). The small number of species recorded from Dong and Glang Islands indicates mainly that few collections were made there.

In the *Florae Siamensis Enumeratio* plants listed by RIDLEY (1922) in the *Flora of the Malay Peninsula* are included. In such cases I cite only RIDLEY in order to not duplicate the record for only a single collection. Every effort has been made to bring names up to date. Many of the names used by RIDLEY (1912) have now been changed.

I have included taxa identified only to genus because I wish to portray the diversity and distribution of species and genera rather than simply publish a flora.

Key to Habits:

T Tree
DT Deciduons tree
E Epiphyte
P Parasite
S Shrub
H Herb
C Climber

Key to Habitats:

1 Mangrove and brackish water forests
2 Freshwater swamp forest
3 Freshwater marsh and aquatic plants
4 Pes-caprae formation
5 Barringtonia formation
6 Coastal heath forest
7 Forest over limestone
8 Scrub forest
9 Semi-evergreen forest
10 Secondary vegetation

The following list shows the distribution at taxa among families, genera and species.

	Families	Genera	Species
Pteridophytes	?	29	49
Gymnosperms	3	3	6
Dicotyledons	96	370	657
Monocotyledons	21	99	157
Totals	120	501	869

Of the 869 taxa listed, the author collected and identified 734; RIDLEY'S and KERR'S works contributed 250 species. One hundred and fifteen species are common to the author's records and RIDLEY'S and KERR'S records.

It must be emphasized that this enumeration is by no means complete. Many of the areas of the park have never been visited by botanists; even those areas where botanists have worked will no doubt produce hundreds of species not yet recorded from the park.

To get an idea of the number of species likely to be found in the park, this enumeration can be compared to the one made by CURTIS (1894) for the island of Penang in Malaysia. CURTIS listed 136 families, 633 genera, and 1805 species of phanerograms known from the island (area 285 km²). The combined area of Tarutao, Adang, and Rawi Islands is approximately 210 km^2. The great variety of habitats in the park may compensate for the smaller area, and the total number of species may be comparable to the total on Penang.

The species/genus ratio for Penang is 2.9; for Tarutao National Park it is 1.9. The lower value for the park may indicate that the flora there has not been thoroughly investigated. It may also reflect that the flora of Penang is inherently richer, probably due to a more seasonal distribution of rainfall. Taking all these factors into account, I tentatively estimate that approximately 2000 species of vascular plants (phanerograms and pteridophytes) occur in Tarutao National Park.

Although a complete analysis of plant distributions has not been performed, it appears that Tarutao National Park may contain a great number of plants that are very rare or absent in the rest of Thailand. *Aegialites rotundifolia*, a mangrove plant found only once before in Thailand, occurs on Tarutao. *Paraboea obovata* Ridley, which occurs at high elevations on Adang Island, is a new record for Thailand (B.L. BURTT, pers. comm.). Many of the species found on the limestone rocks of Tarutao may be restricted to the Tarutao-Langkawi region.

VEGETATION TYPES

The classification and naming of forest formations has varied greatly from place to place and from author to author. In order to avoid adding to this confusion, I have followed WHITMORE (1975) where possible. I have made a few modifications and additions to define minor vegetation types.

Ten fairly distinct types of vegetation occur in the park. One could argue for more if microhabitats and altitudinal variations were emphasized, but that seems unnecessarily complicated. The following composite descriptions illustrate the general floristics and structure of each type and are not meant to exactly describe any one area. Although I have included a great number of plants collected by Ridley and Kerr in the species list, I use only my own collections and observations in describing the vegetation.

Mangrove and Brackish Water Forests (1)

This group includes true mangrove plants, e.g., *Rhizophora*, *Bruguiera*, *Ceriops*, and *Sonneratia*, along with species characteristically found at the back of swamps which may only occasionally come in contact with salt water.

Fairly extensive mangrove swamps occur on Tarutao, covering about 4.5 percent of the island area (MAHIDOL UNIVERSITY, 1977). The biggest and best developed swamps are at Phante Bay, Son Bay, and Talo Udang Bay. At Phante Bay the swamps are bordered by limestone hills, and in some cases mangroves occur in sinkholes completely surrounded by cliffs. Sea water reaches these areas by way of caves through the limestone. Unfortunately I was unable to reach these areas to determine if they were floristically different from more accessible swamps.

Much of the forest was cut 10 to 20 years ago to make charcoal, but it is regenerating quickly. Most of the second growth trees are now 5-10 m high. In the back of the swamp and in isolated pockets undisturbed forest with trees over 20 m high occurs. *Rhizophora apiculata* and *R. mucronata* probably make up at least 70 percent of the trees. These two species are frequently found growing side by side, although *R. mucronata* tends to occur in greater numbers toward the front of the swamp and *R. apiculata* in slightly drier areas. *Aegialites rotundifolia*, a plant found only once before in Thailand by Kerr many years ago, occurs on mud near the entrance to the Phante Bay swamp.

The forests at Son Bay have been disturbed less than those at Phante Bay and big trees are common. *Nypa fruticans* occurs sporadically toward the back of the swamp.

At Talo Udang Bay a typical swamp occurs just west of the headquarters. *Sonneratia caseolaris*, apparently rare in the park, occurs at the back of this swamp. Further west in a sheltered muddy bay an extensive pure stand of *Sonneratia* sp. occurs. Some of these trees are nearly a metre in diameter and have huge limbs that droop down and rest on the mud.

Mangroves are scarce on the Adang Islands, covering less than one percent of the combined areas of Adang and Rawi. These forests are usually confined to narrow strips of land along the shore. The largest swamp occurs on the southwest side of Rawi. *Oncosperma tigillaria* commonly occurs in brackish water at the mouth of streams on the north side of Adang.

A typical mangrove swamp on Tarutao contains the following species : *R. apiculata*, *R. mucronata*, *Bruguiera* spp., *Sonneratia griffithii*, *Avicennia alba*, *A. marina*, and *Xylocarpus granatum* in areas regularly inundated by tides. Behind these on higher ground *Bruguiera gymnorrhiza*, *Lumnitzera littorea*, *Cynometra ramiflora*, *Aegiceras corniculatum*, *Scyphiphora hydrophyllacea*, *Ceriops decandra*, and *C. tagal*. Fringing the back of the swamps are *Excoecaria agallocha*, *Heritieria littoralis*, *Hibiscus tiliaceus*, and *Cassine viburnifolia*. *Acanthus ilicifolius*, *Pluchea indica*, *Clerodendrum indicum*, and the ferm *Acrostichum aureum* are shrubby tidal mud plants. *Caesalpinia crista*, *Randia longiflora*, and *Finlaysonia obovata* climb or scramble over other mangrove plants. A few epiphytic ferns and orchids commonly occur. Herbaceous vegetation includes the sedge, *Mariscus javanicus*, and the grass, *Zoysia matrella*. For a list of mangrove and brackish water plants I recorded from the park see Appendix 2.

Figures 4–9 (p. 153):

4. (top left) Fruit of *Lithocarpus encleisacarpus*, a rain forest tree.
5. (top right) Fruit of *L. falconeri*, rain forest tree.
6. (middle left) *Shorea henryana*, rain forest tree.
7. (middle right) *Strophanthus wallichii*, a climber in secondary vegetation.
8. (bottom left) *Achasma megacheilos*, a rain forest herb.
9. (bottom right) *Amomum hastilabium*, a rain forest herb.

Figures 10–13 (p. 154) :

10. (top left) *Cerbera odollam*, a mangrove shrub.
11. (top right) *Cerbera manghas*, a shrub of coastal heath forest.
12. (bottom left) *Lumnitzera racemosa*, a mangrove shrub.
13. (bottom right) *Aegiceras corniculatum*, mangrove shrub.

Freshwater Swamp Forest (2)

This formation occurs to a very limited extent inland along flat streambeds and along the coast in flat ground where streams enter the sea. On Tarutao the spiny palm, *Salacca conferta*, occurs in dense groves along swampy streambeds. The freshwater swamp on Rawi (Fig. 15) is found just behind the beach. In the rainy season it is partially inundated; the rest of the year it is dry. *Barringtonia acutangula* ssp. *spicata* is the dominant tree there. *Serianthes dilmyi* also occurs just behind the beach, but it is uncommon. Other species found in freshwater swampy areas include : *Alstonia angustiloba*, *Caryota mitis*, *Diospyros pilosanthera*, *Licuala* sp., *Mapania tenuiscapa*, and *Pinanga adangensis*.

Freshwater Marsh and Aquatic Plants (3)

At Talo Udang Bay a number of small springs perpetually moisten the soil. Where the forests have been cleared an open marsh consisting mostly of sedges and other herbs occurs. Typical species include : *Fuirena umbellulata*, *Lepironia articulata*, *Lipocarpha chinensis*, *Eriocaulon* spp. *Ludwigia* spp., *Utricularia* sp., and *Xyris indica*.

Along the edge of streams *Limnophila aromatica* and the fern *Ceratopteris thalictroides* grow. *Barclaya longifolia*, a true aquatic, occurs in slow-moving streams on Tarutao, but I did not find it on Adang.

Pes-caprae Formation (4)

On sandy shores just above high-tide line an herbaceous strand flora occurs. Many of these species are creeping plants well adapted to spreading across and rooting in sand. They also often have fruits that are dispersed by seawater and thus occur on most tropical beaches. *Ipomea pes-caprae* is the the characteristic species of this formation and occurs on nearly every beach in the park. Other common species include : *Canavalia maritima*, *C. microcarpa*, *Cassytha filiformis*, *Cyperus pendunculatus*, *C. radians*, *Ischaemum muticum*, and *Thuarea involuta*. *Ipomea gracilis* and *I. stolonifera* are common at Phante Bay but scarce elsewhere on Tarutao and are totally absent from the Adang Islands. The reason for the restricted distribution of these two species so similar to the widespread *I. pes-caprae* is unclear, but they may not be able to survive on the calcareous beaches of the coral-fringed Adang Islands.

Barringtonia Formation (5)

The woody vegetation behind the beaches and along rocky shores is very uniform. Along most coasts in Thailand this formation has been destroyed, but it is well preserved in the park, especially on the north side of Rawi Islands, where big trees of *Bar-*

ringtonia asiatica, *Calophyllum inophyllum*, and *Terminalia catappa* occur, sometimes with their trunks and limbs lying on the sand. *Dischidia imbricata*, *Hoya* spp., *Pyrrosia adnascens*, and other epiphytes are usually abundant on these trees.

Typical trees of this formation include: *Casuarina equisetifolia*, *Cerbera odollam*, *Chaetocarpus castanocarpus*, *Cocos nucifera*, *Cordia subcordata*, *Diospyros ferrea*, *Erythrina orientalis*, *Erythroxylon cuneatum*, *Eugenia claviflora*, *E. grandis*, *E. syzygioides*, *Ficus geniculata*, *F. rumphii*, *F. superba*, *Guettarda speciosa*, *Heritiera littoralis*, *Hernandia nymphaefolia*, *Hibiscus tiliaceus*, *Pongamia pinnata*, *Suregada multiflora*, *Thespesia populnea*, and *Terminalia catappa*. *Berrya cordifolia*, *Gyrocarpus americanus*, and *Neiosperma oppositifolium* (*Ochrosia*) are uncommon.

Common shrubs are: *Allophylus cobbe*, *Ardisia littoralis*, *Clerodendrum inerme*, *Colubrina asiatica*, *Crinum asiaticum*, *Cycas rumphii*, *Desmodium umbellatum*, *Dodonea viscosa*, *Pandanus odoratissimus*, *Premna corymbosa*, *Scaevola taccada*, *Sophora tomentosa*, and *Vitex trifolia*. *Ximenia americana* is rare.

Woody climbers and vines often scramble over trees and shrubs along the seashore. Some of these are restricted to seashores, whereas others occur in the forest where there is a big enough gap in the forest to give them the light they need to survive. Typical seashore climbers include: *Argyreia mollis*, *Ficus* spp., *Glossocarya premnoides*, *Hiptage benghalensis*, *Ipomea digitata*, *I. tuba*, and *Mucuna gigantea*. The peculiar epiphytic 'ant plant', *Hydnophytum formicarum*, sometimes grows on seashore trees.

Many members of this formation have buoyant fruits adapted to water dispersal, e.g., *Barringtonia asiatica*, and *Heritiera littoralis*. A walk along the beach will often give clues to what species occur in the area.

Coastal Heath Forest (6)

This distinctive formation occurs in small areas at Phante Bay, Son Bay, and in a few other localities. These forests are found on old beaches which are now 1-2 m above the highest tides. These are low (usually not exceeding 6 m), open forests with some herbaceous ground cover and open sandy areas. Shrubs are abundant. *Melaleuca cajuputi* is the dominant tree; *Eugenia spicata* is also abundant.

Typical heath forests as described by WHITMORE (1975) differ considerably from the coastal heath forests at Tarutao. True heath forests are taller, contain more species, and occur in a seasonal Malesia. Since the environmental conditions at some of the Tarutao sites resemble those of heath forests and because many of the species on the Tarutao sites are characteristic of heath forests, I suggest this formation be known as coastal heath forest. In publications by French ecologists, this formation is often known as *L'arriere mangrove* (P.S. ASHTON, pers. comm.).

Heath forest normally occurs on lowland podzols on old beach deposits (WHITMORE, 1975). Such soils are infertile and have a low water-holding capacity. In the wet season they are very dry. They occur on Tarutao and these environmental stresses result in the presence of a very characteristic vegetation composed of species which can survive in such conditions. *Drosera burmannii*, an insectivorous herb, survives here by supplementing its mineral intake with ants and other insects.

The following trees commonly occur in these heaths : *Anacardium occidentale* (introduced), *Diospyros ferrea*, *Eugenia spicata*, *Garcinia cowa*, *G. hombroniana*, *Melaleuca cajuputi*, *Ilex cymosa*, *Mischocarpus sundaicus*, *Myrsine porteriana*, *Neolitsea zeylanica*, *Olea dentata*, *Pittosporum ferrugineum*, *Planchonella obovata*, and *Vitex pinnata*.

Common shrubs are : *Cerbera manghas*, *Rhodamnia cinerea*, *Rhodomyrtus tomentosa*, *Salacia chinensis*, *Spirolobium cambodianum*, *Tetracera indica*, *Styphelia malayana*, and *Vaccinium bracteatum*.

The herbaceous flora includes *Adenosma hirsutum*, *Burmannia coelestis*, *Commelina* sp., *Dianella ensifolia*, *Drosera burmannii*, *Evolvulus alsinoides*, *Ischaemum indicum*, *Sacciolepis indica*, *Sporobolus harmandii*, and *Xyris* sp.

Drynaria quercifolia frequently grows around the base of trees on the heath. The parasite *Dendropthoe pentandra* is common, especially on *Eugenia spicata*. Mosses often form a tussock at the base of *Styphelia malayana* and *Eugenia grata*.

Limestone Vegetation (7)

The northern and eastern portions of Tarutao and offshore islands consist mostly of limestone rocks; the overlying vegetation is very distinctive. The reasons for this are not always clear. Some species appear to be true calcicoles, i.e., adapted to the chemical properties of limestone. Others may be cremnophytes, plants that thrive in the crevices characteristic of limestone cliffs (RICHARDS, 1952). Yet other species may grow on limestone because they adapt better to the moisture stress that occurs in the dry season.

On the vegetation map for Tarutao, all the vegetation over limestone appears the same. This is not really so. On exposed, rocky areas with little or no soil, the vegetation is stunted, thorny, big trees are absent, and there are few herbs. The hills on the north end of Tarutao, where *Euphorbia antiquorum* is present, are an example.

Where moisture and soil are more plentiful, a tall forest to 25 m may occur. *Hopea ferrea*, *Pentaspadon curtisii*, *Sapium insigne*, and *Terminalia triptera* are some of the larger trees. Beneath these, *Diospyros bejaudii*, *D. undulata*, *Hydnocarpus* *ilicifolia, Phyllanthus columnaris*, and other small trees occur. Spiny shrubs *(Canthium* sp., and *Streblus ilicifolius)* and vines *(Grewia viminea)* commonly occur. A rich herb flora characterized by orchids and members of the Gesneriaceae and Zingiberaceae is obvious in the rainy season.

Malaysian botanists have long been interested in the rich and peculiar limestone vegetation of Langkawi. A number of species occur there which are found nowhere else in Malaysia. A number of these species also occur on Tarutao : *Colona merguensis, Euphorbia antiquorum, Pentaspadon curtisii*, and *Sterculia lancaviensis*. Further investigation would probably reveal that the limestone floras of Tarutao and Langkawi are almost identical. *Liberbaileya gracilis*, a palm endemic to the Langkawi limestone, might even occur on the limestone islands off the southern tip of Tarutao.

The limestones on Tarutao and Langkawi are not identical; the Tarutao rocks are older. The effect of this on the overlying vegetation is unknown. The limestone, on Tarutao itself is not uniform. TERAOKA *et al.* (1982) recognized five different facies, some being almost pure limestone, others muddied to varying degrees. I do not know whether the chemical properties and moisture-holding capacities of derived soils vary enough to affect the overlying vegetation.

As already mentioned, the 2–3 months' dry season results in severe moisture stress for the plants on limestone. The shallow soils have a very low moisture-holding capacity. In January and February a majority of the trees on limestone lose their leaves and the herbaceous ground flora dries up. The trees usually flush new leaves in March or April; the herbs revive when the later April and May rains come.

Where limestone and sandstone rocks exist side by side, the effect of the dry season is particularly noticeable. On sandstone most of the trees have leafy crowns; on limestone they are bare. Aerial photographs of the forest at this time of year might aid geologists map the rock formations of the island.

The following trees, shrubs, and herbs commonly occur on the limestone rocks of Tarutao. Trees : *Bombax anceps, Canthium dicoccum, Celtis philippensis, Chionanthus calcicolus, Diospyros bejaudii, D. undulata, Drypetes* cf. *hoaensis, Hydnocarpus ilicifolius, Hopea ferrea, Lagerstroemia* sp., *Pentaspadon curtisii, Phyllanthus columnaris, Sapium insigne, Shorea siamensis, Terminalia calamansanai, T. triptera*, and *Vitex siamica.* Shrubs : *Croton cascarilloides, Desmodium rugosum, Euphorbia antiquorum, Ficus microcarpa, Grewia viminea, Impatiens mirabilis, Leptopus australis, Mallotus dispar, Pavetta naucleiflora*, and *Streblus ilicifolius.* Herbs : *Alocasia denudata, Argostemma* sp., *Arisaema fimbriatum, Begonia* sp., *Boea* spp., *Boesenbergia curtisii, Carex tricephala, Chirita rupestris, Gymnostachyum decurrens, Habenaria carnea, H. goodyeroides, Kaempferia pulchra, Monophyllea patens, Paphiopedilum niveum, Paraboea* spp., and *Sonerila tenera.*

Figure 14. *Aegialites rotundifolia* Roxb., a mangrove shrub, very rare in Thailand.

Figure 15. *Trichospermum javanicum* Bl., a medium tree, rare in secondary vegetation.

Species found on limestone are listed in Appendix 3. CHIN (1973, 1977, 1979) lists all the species known from limestone in Malaya. I have marked species which CHIN did not record with a "+". Species thought to be restricted to limestone are denoted by a "*".

Scrub Forest (8)

The best examples of this type of vegetation occur on the south sides of Adang and Rawi Islands. On steep rocky hillsides there are large grassy areas with shrubs, bamboos, and only a few scattered trees. There is no apparent reason for the lack of trees; perhaps the vegetation was once disturbed by fire.

Cycas pectinata is very common in the shrub formation on the hill above the park headquarters on Adang. Some of the few trees that occur are : *Dillenia obovata*, *Erythroxylum cuneatum*, *Myrsine porteriana*, and *Rhodamnia cinerea*. Shrubs include : *Bridelia tomentosa*, *Calycopteris floribunda*, *Desmodium vestitum*, *Helicteres obtusa*, *Holarrhena curtisii*, and *Tephrosia sp.*

Herbs found in this formation include : *Arundinella setosa*, *Cymbopogon calcicola*, *Dianella ensifolia*, *Eremochloa bimaculata*, *Ischaemum indicum*, *Mesona palustris*, *Mitrasacme pygmaea*, *Osbeckia chinensis*, and *Salomonia cantoniensis*. The bamboo *Dendrocalamus dumosus* forms dense thickets.

Some of the species listed above are found on the Tarutao heaths, indicating that mineral and moisture deficiency may occur here too. Such a deficiency would help to explain the lack of trees.

The scrub on the northern sides of Adang and Rawi is influenced by exposure to severe wind and weather conditions. The trees and shrubs have grown into tight, shrubby forms that follow the contours of the land. Scrubby vegetation is reported (MAHIDOL UNIVERSITY, 1977) in exposed places on Tarutao and on the tops of the mountains, but I was not able to verify this.

Semi-evergreen Rain Forest (9)

Structurally and floristically the rain forests of the park are best classified as Semi-evergreen rain forest (WHITMORE, 1975). As previously mentioned, "semi-evergreen" is somewhat misleading, since only a very small number of canopy trees are deciduous. Roughly 60 percent of Tarutao and 80–90 percent of Adang and Rawi are covered with this type of forest. From a distance, this formation appears as a uniform, perpetually green blanket over most of the land area of the islands. There is, however, a great deal of variation depending on exposure, the availability of moisture, and elevation.

In the lowlands and on gently sloping hills with deep soil, a fine species-rich forest occurs. The biggest trees are 40–45 m tall, but most of the canopy species are 30–40 m. The huge emergents that tower to 60 m in the lowland evergreen forests of Malaya are absent. Members of the Anacardiaceae, Dipterocarpaceae, Leguminosae, Meliaceae, and Sterculiaceae usually form the canopy layer. *Parishia insignis, Swintonia floribunda, Dipterocarpus costatus, D. grandiflorus, Shorea henryana, S. hypochra, Cynometra malaccensis, Intsia palembanica, Aglaia* sp., *Amoora* sp., and *Heritiera sumatrana* are most important. Some *Ficus* and *Eugenia* (*E. rhamphiphylla*) also reach the canopy.

Smaller trees form a second storey about 15–20 m high. Members of the Anacardiaceae, Annonaceae, Ebenaceae, Euphorbiaceae, Guttiferae, and Myristicaceae are common. Typical species are *Buchanania arborescens* (along streams), *Gluta elegans, Polyalthia* spp., *Euonymus javanicus, Lophopetalum* spp., *Diospyros undulata, D. wallichii, Elaeocarpus robustus, Aporusa aurea, Baccaurea parviflora, Garcinia* spp., *Homalium dasyanthum, Milletia atropurpurea, Knema furfuracea, K. globularia, K. laurina, Myristica* spp., *Randia* spp., *Palaquium obovatum, and Payena lanceolata.*

A third layer consists of small trees, saplings, and shrubs. Typical shrubs or small trees are: *Antidesma velutinosum, Ardisia ridleyi, A. stylosa, Donax cannaeformis, Galearia fulva, Glycosmis sapindoides, Goniothalamus macrophyllus, Greenea corymbosa, Ixora javanica, I. umbellata, Lepisanthes fruticosa (Otophora)*, and *Sterculia coccinea.*

A sparse herbaceous layer consists of: *Achasma megacheilos, Amomum* spp., *Aglaonema simplex, Apama tomentosa, Centotheca lappaceum* (grasses are rare in the forest), *Geophila repens* (Tarutao only), *Molineria latifolia*, and *Zingiber* spp.

Along streams, *Begonia sinuata, Elatostema* sp., *Ophiorrhiza* spp., and the ferns *Angiopteris evecta, Cephalomanes javanicum* are abundant. *Aglaonema simplex* is probably the most abundant and conspicuous of the herbaceous species.

Forest palms include: *Areca triandra, Caryota mitis, Nenga* spp., *Orania sylvicola, Pinanga adangensis, Salacca* spp., and rattans.

The following woody climbers, vines, and climbing shrubs commonly occur: *Ancistrocladus pinangianus, Cayratia geniculata, Ficus globosa, F. sagittata, Freycinetia sumatrana, Korthalsia* spp., *Luvunga eleuranthera, Oxymitra* spp., *Neuropeltis racemosa, Poikilospermum suaveolens*, and *Ventilago* spp.

Epiphytes include many orchids, *Macrosolen cochinchinensis* (a parasite), *Asplenium nidus, Drynaria quercifolia, Pyrrosia nummularifolia*, and *Platycerium* sp.

On dry and rocky hillsides the stature of the forest is lower and the species composition changes. *Hopea ferrea* and *Vatica cinerea* tend to replace the other dipterocarps. Small trees found here are : *Adenanthera pavonina*, *Calophyllum calaba*, *Garcinia* spp., *Greenea secunda*, *Memecylon* spp., and *Zanthoxylum rhetsa*.

The shrub flora is sometimes spiny; common members are : *Atalantia monophylla*, *Canthium* spp., *Pavetta* spp., and *Streblus ilicifolius*.

Woody climbers are very abundant : *Calamus* spp., *Connarus monocarpus*, *Dinochloa scandens*, *Erycibe* spp., *Strychnos* spp., and *Tetracera scandens*.

On Adang Island most of the larger lowland trees are not found above 200 m, although a few will occur as high as 330 m where there is ample soil and moisture. Above 350 m elevation Adang becomes dry and rocky and the stature of the forest diminishes greatly. Towards the top of the island (550–700 m), climbers, spiny palms, and small trees become very dense and make walking difficult. In open rocky areas the forest becomes scrubby and contains some members of the Tarutao heath flora : *Myrsine porteriana*, *Eugenia spicata*, and *Rhodamnia cinereus*.

Secondary Vegetation (10)

About 10 percent of the area of Tarutao has been logged, cultivated, or disturbed in some manner. ROBINSON (1917) noted that villagers were logging on Tarutao in 1907. The prisoners exiled to Tarutao in the late 1930's and early 1940's cleared the forest to plant fruit trees and rice. Other areas were cleared to plant rubber trees and coconuts. All but a few of these cultivated areas were abandoned at least 8 years ago and most of them much earlier. Some of the coconut groves are still maintained by park workers. See Appendix 4 for a list of cultivated and/or introduced plants.

These formerly cultivated areas are now grown over with secondary vegetation. In the broad, flat valley behind Chak Bay, several km^2 of land are almost completely covered by *Neyraudia reynaudiana*. This tall (up to 5 m) grass chokes out everything else and it is unlikely that forest will restablish itself there. *Imperata cylindrica* also occurs there and similarly chokes out other species. In most of the other formerly cultivated areas a typical secondary forest of fast-growing, light-demanding trees exists. Common species are : *Alstonia macrophylla*, *A. scholaris*, *Anthocephalus chinensis*, *Callicarpa longifolia*, *Clausena excavata*, *Cratoxylon* sp., *Dillenia obovata*, *Eugenia operculata*, *Gardenia coronaria*, *Glochidion* spp., *Macaranga denticulata*, *M. tanarius*, *Maesa ramentacea*, *Oroxylum indicum*, *Pajanelia longifolia*, *Premna tomentosa*, *Schima wallichii*, *Trema tomentosa*, and *Vitex pinnata*.

Characteristic shrubs are : *Antidesma montanum*, *Blumea balsamifera*, *Bridelia tomentosa*, *Cleistanthus polyphyllus*, *Cnestis palala*, *Eurya acuminata*, *Gmelina elliptica*, *Grewia paniculata*, *Helicteres hirsuta*, *Holarrhena curtisii*, *Melastoma malabathricum*, *Micromelum falcatum*, and *Rhodomyrtus tomentosa*.

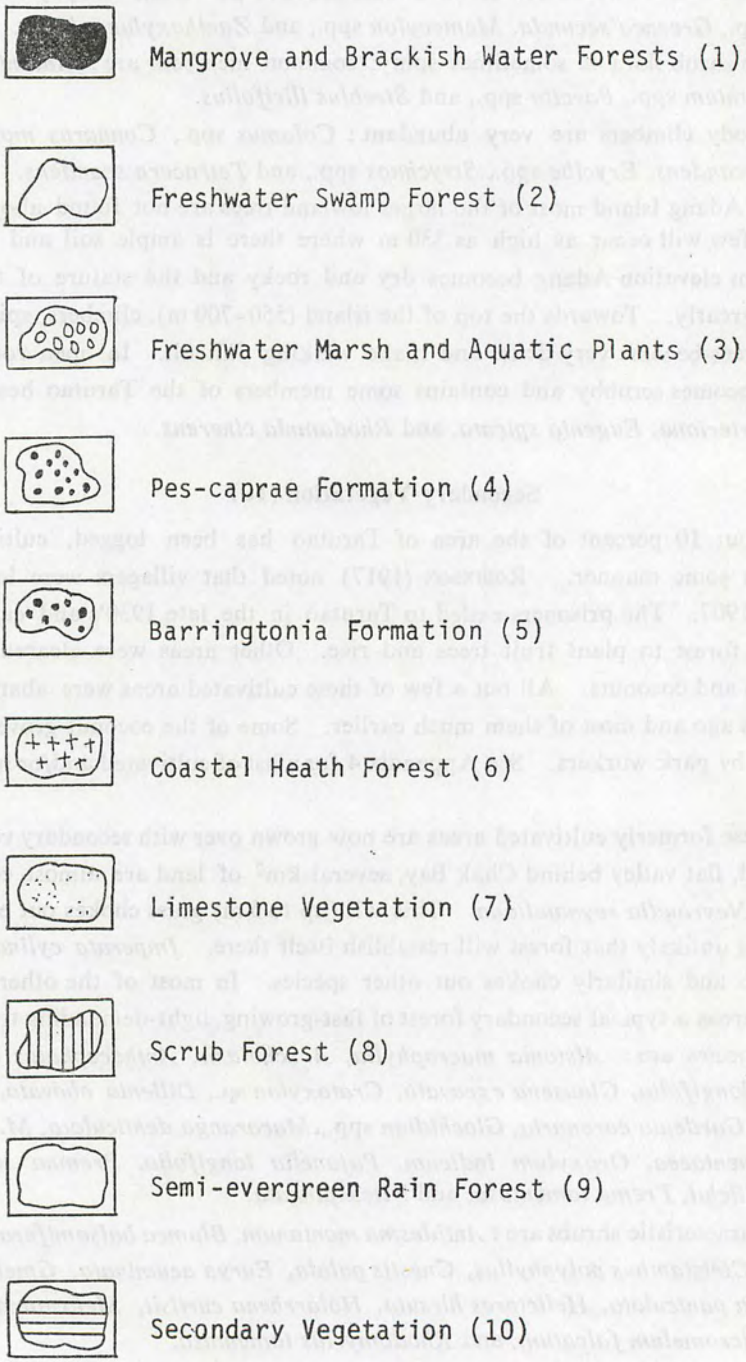

Figure 16. Key to vegetation maps.

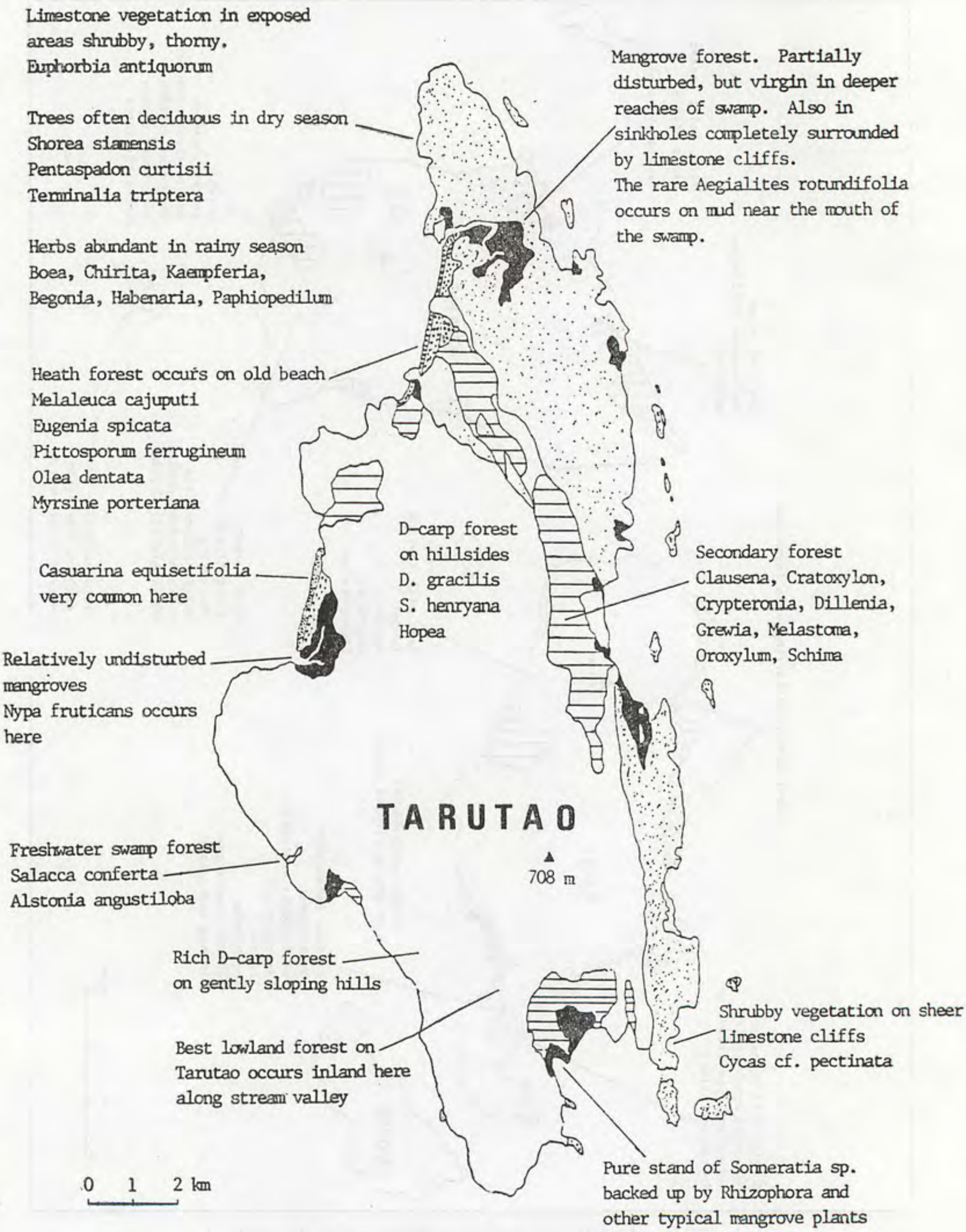

Figure 17. Vegetation map of Tarutao Island.

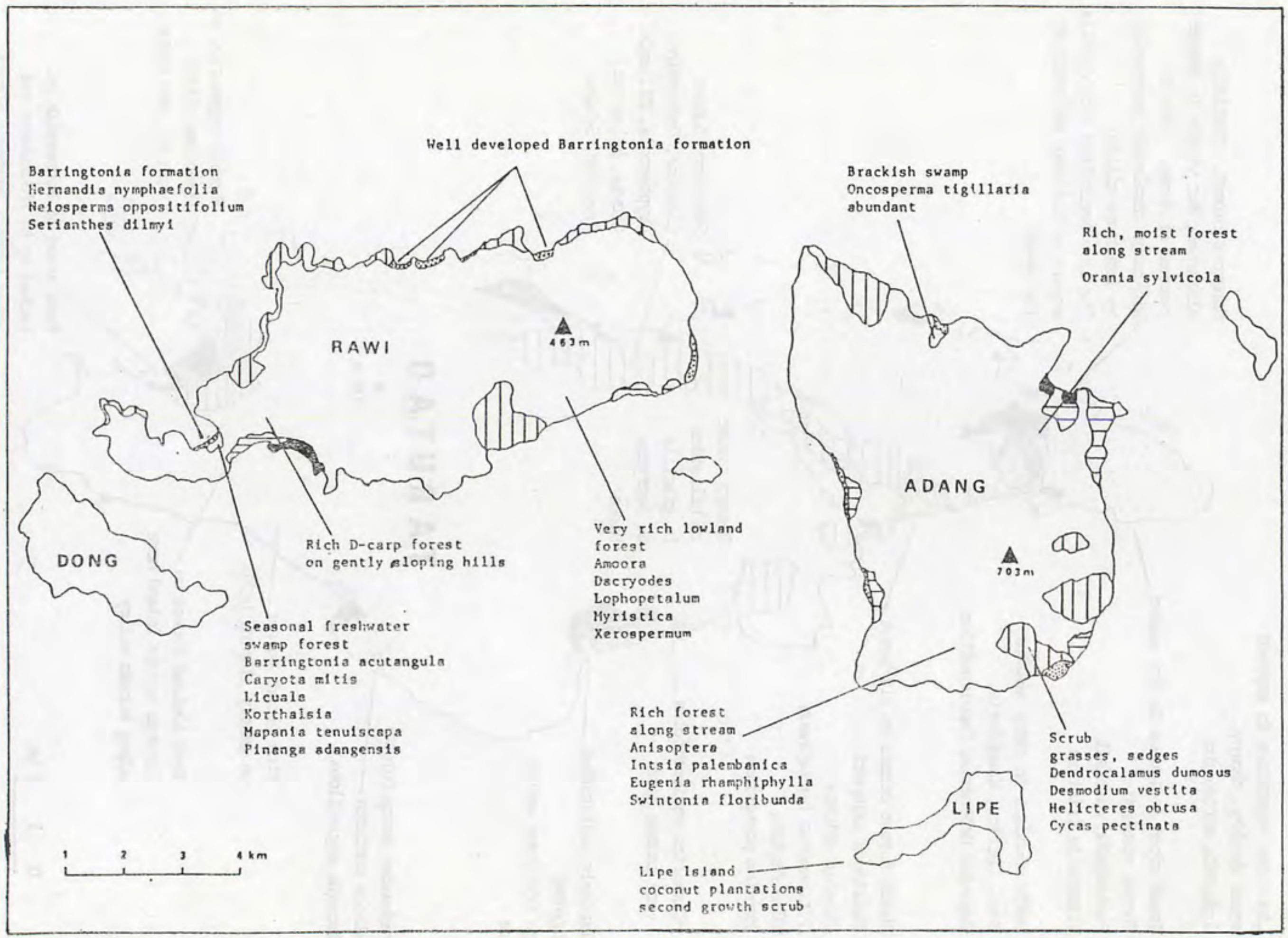

Figure 18. Vegetation map of Adang and Rawi Islands.

Big woody climbers do not exist in these low forests, but a number of smaller climbers do occur : *Connarus semidecandrus*, *Entada spiralis*, *Macrolenes nemorasa*, *Mucuna gigantea*, *Mussaenda villosa*, *Smilax* spp., *Stictocardia tiliifolia*, *Streptocaulon wallichii*, *Trichosanthes tricuspidata*, and *Uncaria sclerophylla*.

A very small amount of secondary forest occurs on Adang and Rawi; the species composition of these forests is similar to those of Tarutao.

VEGETATION MAPS

The vegetation map of Tarutao and the one of Adang and Rawi Islands are based on maps prepared from aerial photos by the Environmental Management Research team from Mahidol University (MAHIDOL UNIVERSITY. 1977). I have modified and simplified their maps, but have followed the broad outlines of vegetation types they used. I have also used different names for forest formations. For mapping forest over limestone on Tarutao I have used the geological maps prepared by TERAOKA, *et al.* (1982).

As mentioned above, those areas which look like uniform expanses of forest on the maps may be very heterogeneous. The maps are intended to delineate only the broadest, most obvious vegetation types, and to point out a few of the more interesting botanical locales. Fig. 16 contains a key to the vegetation maps.

DISCUSSION

Analysis of the species list (Appendix 1) indicates that significant differences in the floras of Tarutao and the Adang Islands occur. Of the 601 species recorded from Tarutao, 405 (67 percent) have not been found on the Adang Islands. Of the 464 species recorded from the Adang group, 268 (58 percent) have not been reported from Tarutao. Only 196 (23 percent) of the 869 species recorded from both island groups have been found in both places. This striking difference in floristic composition may have at least three explanations : 1) collecting bias, 2) local edaphic differences and 3) a fundamentally different affinity.

The first of these possible explanations, collecting bias, may explain a good deal of the floristic variation indicated by the above figures. The park has been very poorly collected and species distributions are not well known. Much more information is needed to adequately assess any differences between the floras of the Tarutao and Adang groups. Nevertheless, using the information at hand, it is possible to suggest some reasons for the observed differences and to cautiously evaluate RIDLEY'S (1922) assertion that the Adang flora is more Malayan than the flora of Tarutao.

Local edaphic differences between Tarutao and the Adang group explain many of the observed differences in their floras. Many of the species restricted to limestone habitats on Tarutao are totally absent from the Adang islands. Large areas of mangrove swamp and secondary vegetation occur on Tarutao. These habitats are hardly represented in the Adang group and their characteristic species are largely absent. Similarly, the large areas of granite rock which commonly occur in the Adang Islands are absent from Tarutao.

To test RIDLEY's theory we should look at the tall, primary forest of the islands. Do structural and/or floristic differences occur here ? Are any of the species used by WHITMORE (1975) to characterize the Malayan forests present on Adang ? No members of the characteristically Malayan Red Meranti group of *Shorea* occur on either Tarutao or Adang. Two White Meranti species, *Shorea henryana* and *S. hypochra*, occur in the park. *S. henryana* is one of the most abundant big trees on both Tarutao and Adang. *S. hypochra* has been recorded only from Tarutao, but likely occurs on Adang as well. Two species with Malayan affinities, *Dipterocarpus hasseltii* and *Anisoptera curtisii*, occur on Adang but have not been found on Tarutao. The Malayan *Hopea latifolia* and *Vatica stapfiana* have been found on Tarutao, but not on the Adang Islands. Of the 13 species of Dipterocarpaceae known from Tarutao, 4 have Malayan affinities and 9 have either Indo-Chinese or Indo-Burmese affinities. Similarly, 5 of the 11 Dipterocarp species from the Adang group show Malayan affinities, the other 6 show Indo-Burmese or Indo-Chinese affinities (SMITINAND *et al.*, 1979).

Balanocarpus heimi and *Eugeissonia tristis*, two species used by WHITMORE (1975) to characterize the Malayan forests, have not been found in the park. Of the small forest palms used by WHITMORE to characterize the Malayan forests, *Nenga*, *Areca*, and *Pinanga*, all three genera are found on Tarutao, but only the latter two on the Adang group. *Dipterocarpus kerrii* and *Intsia palembanica*, two species typical of Thai forests (WHITMORE, 1975), occur on Adang. *D. kerrii* has not been recorded from Tarutao.

Thus the distribution of dipterocarp and other 'indicator' species from WHITMORE gives no indication that the flora of Adang is more Malayan in character than the flora of Tarutao.

RIDLEY (1912) wrote that the flora of the Adang Islands seemed to have relations with that of the Andaman Islands, which he said had a Malayan flora. We now know that the Andaman flora is more closely related to the Thai and Indo-Burmese floras than to the Malayan flora (P.S. ASHTON, pers. comm.).

In conclusion, it appears that the observed differences in the floras of Tarutao and the Adang group are due largely to edaphic reasons and not to fundamentally different affinities of their floras as RIDLEY suggested. Additional collections from the granite hills of the Adang group might turn up some typically Malayan species, but the lowland forests of the Adang Islands structurally and floristically resemble the Thai-type forests found on Tarutao.

The only possible explanation I can offer for RIDLEY'S ideas about the Adang flora is that the deep, rich soils of the lowlands on Adang, and particularly on Rawi, support a tall, species-rich forest. Members of the Meliaceae, Sapotaceae, Burseraceae, Annonaceae, and Myristicaceae seem to be more abundant here than on Tarutao. Members of these families and the overall appearance of the forests probably reminded RIDLEY of the forests that occur further south. Closer structural and floristic analysis reveals that these are merely well developed Thai-type forests on deep, fertile soils.

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APPENDIX 1.

PLANTS OF TARUTAO NATIONAL PARK

PTERIDOPYTES

	T	A	R	D	G
LYCOPODIACEAE					
Lycopodium sp.	C				
SELAGINELLACEAE					
Selaginella minutifolia Spr.			R		
Acrostichum aureum L. 1	C				
Adiantum capillus-veneris L. 5			R	R	C R
A. malesianum Ghatak 7	C				
A. philippense L. 5	C				
Angiopteris evecta (Forst.) Holttm. 9		C			
Antroohyum callifolium Bl. 7	C				
A. reticulatum Kaulf.			R		
Blechnum orientale L. 10	C				
Bolbitis appendiculata (Willd.) Iwats. 9		C			
B. virens (Wall.) Schott		R	C		
Cephlomanes javanicum (Bl.) van den Bosch 9	C				
Ceratopteris thalictroides (L.) Brongn. 3	C				
Cheilanthes tenuifolia (Burm.) Sw. 8(10)	C		C		
Davallia denticulata (Burm.) Mett. 10	C				
Davallia solida Sw.		R			
Doryopteris ludens (Wall.) J. Sm. 7	C				
Drynaria quercifolia (L.) J. Sm. 5(6)	C	C R			
D. rigidula (Sw.) Bedd. 7(1)	C				
Humata vestita (Bl.) Moore 9		C			
Lindsaea ensifolic Sw. 9		C			
L. repens (Bory) Thwaites var. pectinata (Bl.) Mett. ex Kuhn		C	C		
Lygodium flexuosum (L.) Sw. 10	C				
L. microphyllum (Cav.) R. Br. 10	C				
Microlepia speluncae (L.) Moore 10	C				
Nephrolepis biserrata (Sw.) Schott.	C				
N. hirsutula (Forst.) Pr. 9					C
Phymatodes scolopendria (Burm.) Ching 5(7)					R
P. sinuosa (Wall.) J. Sm. 9		C	C R		
Platycerium sp. 9	C				
Pleocnemia irregularis (Pr.) Holtt. 10		C			
Pteris sp. 9		C			
Pyrrosia adnascens (Forst.) Ching 5(7)	C	C R	C		C
P. longifolia (Burm.) Morton 9(10)	C	C			
P. nummularifolia (Sw.) Ching 9	C				
P. stigmosa (Sw.) Ching 7	C				
Schizaea digitata (L.) Sw. 9	C	C			
Stenochlaea palustris (Burm.) Bedd. 3	C				
Taenitis blechnoides (Willd.) Sw. 9	C	C			
Tectaria barberi (Hk.) Copel.					C
T. polymorphum (Wall.) Copel.			R		
T. singaporiana (Wall. ex Hk. et Grev.) Ching 9	C				
T. variolosa (Wall.) ex Hk.) C. Chr. 7	C				
Thelypteris interrupta (Willd.) K. Iwats. 10	C				
T. parasitica (L.) K. Iwats. 10	C				
Vittaria elongata Sw.		R			
V. ensiforme Sw. 9	C		C		
V. flexuosa Fee		R			

GYMNOSPERMS

	T	A	R	D	G
CYCADACEAE					
Cycas pectinata Griff. T, 8		C			
C. rumphii Miq. T, 5	C R	C			
GNETACEAE					
Gnetum cuspidatum Bl. C, 10	C				
G. latifolium Bl. C, 9	C				
G. macrostachyum Hook. f. C, 10	C	C R			
PODOCARPACEAE					
Podocarpus wallichianus Presl. T, 9	C	C			
ANGIOSPERMS					
Dicotyledons					
ACANTHACEAE					
Acanthus ilicifolius L. S, 1, 5-6	C	R	R		
Andrographis paniculata Nees H	R				
Gymnostachyum decurrens Stapf. H, 7, 10, 10	C				
G. insulare Ridl. H			R		
G. sp. H, 9, 6		C			
Hemigraphis hispida Craib H, 9, 8, 8	C				
Justicia gendarusa L. H			R		
J. inconspicua Ridl. H, 9, 10			C R		
J. ptychostoma Nees H, 9, 1, 1	C				
J. sp. H, 7, 11	C				
J. sp. H, 7, 10-11	C				
J. sp. H, 9, 12		C			
Lepidagathis sp. H, 9, 2		C			
Peristrophe tinctoria Nees H, 5, 11	C				
Pseuderanthemum cf. candidum Ridl. H, 9, 2			C		
P. crenulatum Radlk. H		R			
P. graciliflorum Ridl. H, 9(7), 10-12	C	C	C		
Staurogyne sp. H, 9, 2, 2			C		
Strobilanthes sp. H, 9, 2		C			
Thunbergia fragrans Roxb. V, 8, 10		C			
T. laurifolia Lindl. V, 10, 2	C				
AMARANTHACEAE					
Acyranthes aspera L. H, 9, 10	C				
Deeringia amaranthoides (Lamk.) Merr.					R
ANACARDIACEAE					
Bouea oppositifolia (Roxb.) Meisn. T, 9, 2, 3		C	C		
Buchanania arborescens (Bl.) Bl. T, 5(9), 2, 3	C	C R			
B. sessifolia Bl. T, 9, 2		C R			
Gluta elegans (Wall.) Hook. f. T, 9(5), 1, 3	C		C		
Parishia insignis Hook. f. DT, 9, 2	K	C R			
Pentaspadon curtisii (King) Corner DT, 7,7	C				
Semecarpus cochinchinensis Engl. T	K				
S. curtisii King T 9(10), 1-3, 1-3	C	C			
Spondias pinnata (L. f.) Kurz DT, 5(8), 3, 6	C	C	C		
Swintonia floribunda Griff. T, 9	C	C	C		
ANCISTROCLADACEAE					
Ancistrocladus pinangianus Wall. C, 9, 1		C	C		
ANNONACEAE					
Cananga latifolia (Hk. f. et Th.) Finet et Gagnep. T, 7(8)	C K	C			
Cyathostemma excelsum (Hk. f. et Th.) J. Sinclair C	R				
Desmos dasymaschalus (Bl.) Safford S			R		
Enicosanthum cf. congregatum (King) Airy-Shaw T, 7, 4	C				

	T	A	R	D	G
ANNONACEAE (cont.)					
Goniothalamus macrophyllus (Bl.) Hk. f. S, 9, 10-11, 2		C R	C		
Oxymitra cf. affinis Hk. f. C, 9, 6		C			
O. discolor Craib C			R		
O. glauca Hk. C dubious record			R		
Polyalthia cinnamonea Hk. f. et Th. T, 9, ?, 6		C			
P. parviflora Ridl. T		R			
P. sp. T, 9, ?, 11	C				
Stelechocarpus cauliflorus (Scheff.) R. E. T, 9, 11, 11	C				
APOCYNACEAE					
Aganosma marginata Don C, 10	C	C K	C		
A. sp. C, 7, 10	C				
Alstonia angustiloba Miq. T, 2	C				
A. macrophylla G. Don T, 10, 10		C K			
A. scholaris Br. T, 10	C	C			
Alyxia nitens Kerr C		K			
Cerbera manghas L. T, 5(6)	C		C		
C. odollam Gaertn. 5(1)	C	C			
Holarrhena curtisii King et Gamble S, 10(8), 3-6	C		C R		
Melodinus orientalis Bl. C, 10, 10, 11	C				
Neiosperma oppositifolium (Lam.) Fosb. & Sach. T, 5, 6		C R K	C		
Parsonsia helicandra Hk. et Arn. V	K				
Spirolobium cambodianum Bail. S, 6	C	K			
Strophanthus wallichii A. DC. C, 10, 3, 10		C			
Wrightia cambodiensis Pierre T	K				
W. dubia (Sims) Spreng, S, 10, 3			C		
W. pubescens R. Br. T, 10, 1, 1	C	C			
ARALIACEAE					
Aralidium pinnatifidum Miq. T, 9, ?, 7	C				
Schefflera elliptica (Bl.) Harms C, 5, ?, 2	C	C R K			
S. heterophylla (Wall ex G. Don.) Harms C, 9, 7, 4	C				
ARISTOLOCHIACEAE					
Apama tomentosa Soler. H, 9, 4	C				
Aristolochia curtisii Gamble V, 9		C			
A. tagala Cham. V, 9, 3	C				
ASCLEPIADACEAE					
Ceropegia cf. langkawiensis Rintz. V, 7, 10	C				
Cyanchum ovalifolium Wight. C, 10, 3, 3	R	C			
Dischidia benghalensis Colebr. E		R			
D. imbricata (Bl.) Steud. E, 5, 1					C
D. major (Vahl) Merr E, 5	C	C			
D. nummularia R. Br. E				R	
Dregea volubis (L. f.) Bth. ex Hk. f. V, 5, 3, 10					C
Finlaysonia obovata Wall. V, 1, 10, 3	C				
Hoya flagellata Kerr V	K				
H. parasitica Wall. V					R
Raphistemma pulchellum Wall. V, 7, 8-10	C				
Sarcostemma brunonianum Wight & Arn. V, 7, 7	C				
Secamone micrantha Dcne. V, 7, 6	C R K				
Streptocaulon wallichii Wight V, 10, 10	C				
BALSAMINACEAE					
Impatiens mirabilis Hk. f. S, 7, 3-4, 3-4	C R				
BARRINGTONIACEAE					
Barringtonia acutangula (L.) Gaertn. ssp. acutangula T, ?, 3, 3-4	C		C		
B. acutangula ssp. spicata (Bl.) Payens T, 2, 2, 7	C				
B. asiatica L. T, 5	C	C	C		
B. macrostachya (Jack) Kurz T	C K				
BIGNONIACEAE					
Dolichandrone spathacea (L. f.) K. Schaum. T, 1	C	C			
Oroxylum indicum Vent. T, 10(7), 10, 10	C				

	T	A	R	D	G
BIGNONIACEAE (cont.)					
Pajanelia longifolia (Willd.) K. Schaum. T, 10, 3, 3	C				
Stereospermum fimbriatum (Wall. ex G. Don) A. DC. DT, 8(7), 2, 5-6	C	C			
BOMBACACEAE					
Bombax anceps Pierre DT, 7(8), 1-2, 2-3	C R	C R			
B. ceiba L. T		R			
BORAGINACEAE					
Cordia subcordata Lamk. T, 5, 11, 11	C	R	C		
Tournefortia argentea L. S		R K			
BURSERACEAE					
Dacryodes rostrata (Bl.) Lam T, 9			C		
CAPPARIDACEAE					
Capparis micrantha DC. S, 8(9), 10-1		C R			
C. sepiara L. C, 7, ?, 4	C				
CASUARINACEAE					
Casuarina equisetifolia Forst. T, 5	C	C R	C		
CELASTRACEAE					
Bhesa robusta (Roxb.) Hou T, 10(9)	C	C			
Cassine viburnifolia (Juss.) Hou T, 1	C				
Euonymus javanicus Bl. T, 9, 3(9), 6(9)	C	C	R		
Kokoona littoralis Laws T, 9, 3			C		
Loesneriella pauciflora (DC.) A. C. Smith C, 5, 2, 2	K	C			
Lophopetalum cf. wightianum Arn. T, 9, 2			C		
Microtropis bivalvis (Jack) Wall. T, 9, 2		C	C		
Pleurostylia opposita (Wall.) Alston T, 9, 6, 6		C			
Salacia chinensis L. S, 6, 2	C				
S. macrophylla Bl. C	R	R			
COMBRETACEAE					
Calycopteris floribunda (Roxb.) Lamk. C, 9(8), 2	C	C	C		
Combretum latifolium Bl. C, 8, 1	K	C			
Lumnitzera littorea (Jack) Voight T, 1	C				
L. racemosa Willd. T, 1	C	C			
Terminalia calamansanai (Blanco) Rolfe T, 7, 9	C R				
T. catappa L. T, 5	C	C R K	C R K		
T. cf. nigrovenulosa Pierre ex Lanessan 7	C				
T. triptera Stapf. 7, 7	C				
COMPOSITAE					
Adenostemma lavenia O. Kze.	K				
Blumea balsaminifera (L.) DC. S, 10, 2	C	C			
Elephantopus scaber L. H, 10, 11	C	C			
Eupatorium odoratum L. H, 10	C	C			
Mikania cordata (Burm. f.) B. L. Robinson 10(7)	C				
Pluchea indica (L.) Less S, 1	C				
Struchium sparghanophorum (L.) O. K. H, 3	C				
Synedrella nodiflora Gaertn. H, 10	C				
Tridax procumbens L. H, 10, 10		C			
Vernonia cinerea (L.) Less H, 10(7)	C				
V. curtisii Craib H, 7, 10	C				
V. rupicola Ridl. H, 8		C			
Wedelia biflora DC. H, 4(1)	C	C R	C		
Youngia japonica (L.) DC. H, 4, 6	C				
CONNARACEAE					
Agelaea borneensis (Hk. f.) Merr. C			R		
Cnestis palala (Lour.) Merr. S, 10, ?, 2	C				
Connarus monocarpus L. ssp. malayensis Leenh. C, 9, 2	K	C			
C. semidecandrus Jack C, 10, 2-3, 2-3	C				

	T	A	R	D	G
CONVOLVULACEAE					
Argyreia mollis (Burm. f.) Choisy C, 5, 10		C			
Erycibe sp. C, 10(9), 2	C	C			
E. sp. C, 9, 2		C			
Evolvulus alsinoides L. H, 6, 6	C				
Ipomea aquatica Forsk H, 2, dubiously wild	C				
I. aquatica Forsk, white-flowered form, dubiously wild	C				
I. digitata L. var. eriosperma (P. B.) Rendle C, 5, 6	C				
I. gracilis R. Br. V, 4	C				
I. illustris (Clarke) Prain V					R
I. pes-caprae (L.) R. Br. V, 4	C	C R	C		
I. stolonifera (Cyr.) Gmel. V, 4	C				
I. tuba (Schlechtend.) G. Don 5, 1(9)		C			C
Merremia tridentata (l.) Hallier f. ssp. hastata (Desr.) Oostr. V, 10, 2	C				
Neuropeltis racemosa Wall. C,), ?, 1		C			
Stictocardia tiliifolia (Desr.) Hallier f. C, 10, ?, 2	C K				
CRYPTERONIACEAE					
Crypteronia paniculata Bl. T, 10	C				
CUCURBITACEAE					
Trichosanthes tricuspidata Lour. V, 10, 8, 2	C				
DICHAPETALACEAE					
Dichapetalum sp. S, 10, 6-8	C				
DILLENIACEAE					
Acrotrema costata Korth. T, 9		C	C		
Dillenia obovata (Bl.) Hoogl. T, 10(8), 2	C	C R	R		
Tetracera indica (Christm. & Panz.) Merr. S, 10(6), 4	C	C	R		
T. scandens (L.) Merr. C, 9	C				
DIPTEROCARPACEAE					
Anisoptera costata Korth. T, 9	C	C	C		
A. curtisii Dyer ex King T, 9		C			
Dipterocarpus costatus Gaertn. f. T, 9	C	C	C		
D. gracilis Bl. T, 9, 4, 4	C				
D. grandiflorus Blanco T, 9, 1-2, 1-6	C	C	C		
D. hasseltii Bl. T				R	
D. kerrii King T, 9			C		
Hopea ferrea Laness. T, 8(7), 10, 12-2	C	C	C		
H. latifolia Sym. T, 9, ?, 3	C				
H. odorata Roxb. 9, no specimen, but reported from Tarutao and Adang	?	?			
Shorea henryana Pierre T, 9, 3	C	C	C		
S. hypochra Hance T, 9	C				
S. siamensis Miq. T, 7, 11, 3	C				
Vatica cinerea King T, 5(8), ?, 2	C	C			
V. odorata (Griff) Sym. T, 8, ? 2	C	C			
V. stapfiana (King) V. sl. T, 9	C				
DROSERACEAE					
Drosera burmanni Vahl H, 6	C				
D. indica L. H, 9, 10		C			
EBENACEAE					
Diospyros bejaudii Lec. T, 7, 11	C				
D. buxifolia (Bl.) Hiern T		R			
D. ferrea (Willd.) Bakh. T, 1(6), 1-2	C	C			
D. montana Roxb. T, 5		C			
D. pilosanthera Blanco var. chikusensis Ng T, 2, ?, 7	C				
D. sumatrana Miq. T, 9, 2	C	C K	C R		
D. toposia Buch.-Ham T, 9, ?, 11	C				
D. undulata Wall. ex G. Don T, 9(7)	C	C			
D. variegata Kurz T 9, 3	C				
D. wallichii King & Gamble ex King T, 9	C	C			C
ELAEOCARPACEAE					
Elaeocarpus robustus Roxb. T, 9, 8, 8	C	C			

	T	A	R	D	G
EPACRIDACEAE					
Styphelia malayana (Jack) Spr. recorded by Tem Smitinand	C				
ERICACEAE					
Vaccinium bracteatum Thunbg. S, 6, 10	C				
ERYTHROXYLACEAE					
Erythroxylon cuneatum (Miq.) Kurz T, 5(8), 6		C	C		
EUPHORBIACEAE					
Actephila excelsa (Dalz.) M. A. var. javanica (Miq.) Pax & Hoffm. 5, 9, 10, 10		C			
Agrostistachys gaudichaudii M. A. T, 10, 3, 3	C R				
Antidesma ghaesembilla Gaertn. T, 10, 3	C				
A. cf. leucocladon Hk. f. T, 9, 3		C			
A. montanum Bl. S, 10, ?, 2		C R			
A. velutinosum Bl. T, 9, 12-2, 3	C	C			
Aporusa aurea Hk. f. T, 9, 1, 3	C		C		
A. dioica (Roxb.) M. A. T			R		
Baccaurea parviflora (M. A.) M. A. T, 9, 2			C		
B. lanceolata M. A. t			R		
B. ramiflora Lour. T, 9(10), ?, 2 dubiously wild	C				
Breynia reclinata (Roxb.) Hk. f. T, 8		C			
B. vitis-idaea (Burm. f.) C. E. C. Fischer S, 10(4), ?, 11	C	C			
Bridelia ovata Dcne. S, 8, ?, 1					C
B. tomentosa Bl. T, 10(8), 10, 2	C	C			
Chaetocarpus castanocarpus Thwaites T, 5(10)	C	C			
Cladogynos orientalis Zipp. ex Span. S	R				
Claoxylum indicum (Reinw. ex Bl.) Hassk. T, 8(7), 2, 6	C	C			
C. longifolium (Bl.) Endl. ex Hasskl T, 9, 3	C				
Cleistanthus polyphyllus F. N. Williams S, 10, 2, 6	C				
Cnesmone javanica Bl. Bijdr. V, 9	C				
Croton cascarilloides Raeusch S, 7, 5-10, 5-10	C				
Drypetes hoaensis Gagnep. T, 7, 4	C				
Drypetes sp. T, 9, ?, 6		C			
Euphorbia antiquorum L. S, 7	C				
E. atoto Forst. f. S, 5	C	C R			
Excoecaria agallocha L. T, 1, 6	C	C R			
Galearia fulva (Tul.) Miq. T, 9, 2	C	C			
Glochidion arborescens Bl. T, 10, 8, 8	C R				
G. cf. lanceolarium (Roxb.) Voigt. T, 5, 10, 10	C				
G. obscurum (Roxb. et Willd.) Bl. T, 10, 3	C				
G. penangensis (M. A.) Airy Shaw T, 9, 2, 2	C	C			
Leptopus australis (Zoll. et Mor.) Pojarkova S, 7, 6-10, 6-10	C				
Macaranga denticulata (Bl.) M. A. T, 10, 11	C	C			
M. gigantea Mull. T, 10, 3	C				
M. tanarius (L.) M. A. T, 10, ?, 2	C	C			
Mallotus dispar (Bl.) M. A. T, 7	C				
M. oblongifolius (Miq.) M. A. T, 10(9)	C	C			
M. paniculatus (Lam.) M. A. T, 10, ? 10		C			
M. peltatus (Geisel.) M. A. S, 9, 11			C		
M. subcuneatus (Gage) Airy Shaw S, 9		C			
Microdesmis caesarifolia Planch T, 9		C			
Phyllanthus albidiscus (Ridl.) Airy Shaw T	R				
P. columnaris M. A. T, 7, 7, 12	C				
P. elegans Wall. ex M. A. S, 9, 10, 10	C	C R			
P. gracilipes Mull. S	R				
Sapium insigne (Royle) Benth. DT, 7	C				
Sauropus villosus (Blanco) Merr. S, 7, 7	C				
Sebastiana chamalea (L.) M. A. H, 6	C				
Suregada multiflora (A. Juiss.)Baill. , 5, 10		C R			C
FAGACEAE					
Castanocarpus sp. T, 9, ?, 7	C				
Lithocarpus falconeri (Kurz) Rehd. T, 9, ?, 3	C				
L. elegans (Bl.) Hatus ex Soepadmo T, 9, 4	C				
L. encleisacarpus (Korth.) A. Camus T, 9, ?, 3	C				

	T	A	R	D	G
FLACOURTIACEAE					
Homalium caryophyllaceum (Z. & M.) Benth. T, 7, 7	C				
H. dasyanthum (Turcz.) Warb. T, 9, 1-2	C	C R K	R K		
Hydnocarpus ilicifolia King T, 7, 6, 10	C				
H. sp. T, 9, ?, 2	C				
Scolopia spinosa (Roxb.) Warb. T, 9, 2, 3	K	C			
GESNERIACEAE					
Boea lancifolia Ridl. H	R				
Chirita involucrata Ridl. H, 8, 4-9, 4-9		C			
C. rupestris Ridl. H, 7, 4-9, 4-9	C				
Monophyllea glabra Ridl. H, 7, 5-9	C				
Paraboea obovata Ridl. H, 8, 6, 6		C			
P. sp. H, 7	C				
P. sp. H, 7, 7, 7	C				
P. sp. V, 7, 5-10, 5-10	C				
GOODENIACEAE					
Scaevola taccada (Gaertn.) Roxb. S, 5	C	C R	C		C
GUTTIFERAE					
Calophyllum calaba L. var. bracteatum (Wight) P. F. S. 9(8)	C	C	C		C
C. inophyllum L. T, 5	C	C	C		
C. soulattri Burm. T, 9	C				
C. tetrapterum Miq. var. tetrapterum	C				
Garcinia cowa Roxb. T, 6	C				
G. gaudichaudii Planch & Triana T, 9, 2, 2-3		C			
G. hombroniana Pierre T, 6, 10-2, 2	C	C			
G. merguensis Wight T	R				
G. cf. xanthochymus Hk. f. T, 9, 3	C				
G. sp. T, 9, 2		C			
HERNANDIACEAE					
Gyrocarpus americanus Jacq. DT, 5, 12, 2-3					C R
Hernandia nymphaefolia (Presl.) Kubitzki T, 5			C	R	
HYPERICACEAE					
Cratoxylum cf. formosum (Jack) Dyer T, 10, 3	C				
ICACINACEAE					
Stemonurus cf. malaccensis (Mast.) Sleum. T, 9		C			
LABIATAE					
Gomphostemma javanicum (Bl.) Bth. H, 9, 1	C				
Hyptis brevipes Poit. H, 10, 11	C				
Leucas zeylanica (L.) R. Br. H, 10	C				
Mesona palustris Bl. H, 8, 12		C			
LAURACEAE					
Cassytha filiformis L. V, 4	C	C R	C		
Cinnamomum iners Reinw. T, 10	C				
C. cf. parthenoxylon Meissn. T, 9, 1	C				
C. sp. T, 9		C			
Cryptocarya sp. T, 10, ?, 8	C				
C. sp. T, 10, 10		C			
Dehaasia cuneata Bl. T			R		
Litsea grandis Hk. f. T, 10	C				
L. umbellata (Lour.) Merr. T, 10, 6-8	C		C		
Neolitsea zeylanica Merr. T, 6, 11	C				
Phoebe paniculata Nees T, 10, 11	C				
P. sp. T, 10. 1	C				
P. sp. T, 10		C			
LEEACEAE					
Leea indica (Burm. f.) Merr. S, 10, 3, 2	C	C R			
L. rubra Bl. S, 7, 6-10	C				

	T	A	R	D	G
LEGUMINOSAE					
Caesalpinoideae					
Bauhinia curtisii Prain C, 7, 6	C				
B. glauca (Wall. ex Benth.) Benth. ssp. glauca C, 10, 1-2, 2		C			
B. pottsii G. Don C, 10, 9-10	K	C			
Caesalpinia bonduc (L.) Roxb. emend. Dandy & Exell S, 10(5)	C				
C. crista L. S, 1, 1	C				
C. digyna Rottl. S, 10, ?, 10	C				
Cassia siamea Lam. T, 10, 7	C				
C. timoriense DC. T, 10, 10		C			
Crudia cf. lanceolata Ridl. T, 9, 9, 10		C			
Cynometra malaccensis Meeuwen T, 9, 11	C				
C. ramiflora L. T, 1	C	C	K		
Intsia palembanica Miq. T, 9, ?, 9	C	C	C		
I. bijuga (Colebr.) O. K. T, 1, 2		C			
Peltophorum pterocarpum (DC.) Back. T, 1, 3	C R	C R	K		
Pterolobium sp. C, 10, 12, 12	C				
Mimosoideae					
Adenanthera pavonina L. T, 9(10), ?, 6		C			
Albizzia myriophylla Benth. S, 10(7)	C R	C R			
Archidendron clypearia Nielsen T, 10, 12	C				
A. jiringa Nielsen T, dubiously wild 2, 2	C	C	C		
Entada spiralis Ridl. C, 10, 3, 4	C				
Mimosa pudica S, 10	C				
Parkia javanica (Lamk.) Merr. T, 9, ?, 2	C	C			
P. speciosa Hassk. T, dubiously wild	C				
Serianthes dilmyi Fosb. T, 2(5), ?, 6			C		
Papilionoideae					
Canavalia maritima (Aubl.) Piper V, 4, 10	C				
C. microcarpa (DC.) Merr. V, 5, 10	C K				
Clitoria sp. H, 10, 9, 9		C			
Crotolaria pallida Ait. H, 10, 8, 8	C				
Dalbergia candenatensis (Dennst.) Prain C, 1, 3	C				
D. pinnata (Lour.) Prain C, 10, 8, 10	C				
D. rostrata Grah. C, 9, 6	C				
Derris amoena Benth. C			R		
D. cf. heptaphylla (L.) Merr. C, 1, 7	C				
D. scandens Benth. C	R K				
Desmodium heterocarpon DC. S, 10, 8, 10	C				
D. rugosum Prain S, 7, ?, 10	C				
D. cf. trifoliastrum Miq. S, 9, 6, 6			C		
D. umbellatum DC. S, 1	C	C	R		C
D. vestitum Baker S, 8, 12		C	C		
Erythrina orientalis (L.) Murr. T, 5(7), 1	C	C			
E. rostrata Ridl. T doubtful species		R			
E. suberosa var. horrida Ridl. T doubtful species	K				
Milletia atropurpurea Benth. T, 9	C	C			
Moghania macrophylla (Willd.) O. K. S, 10	C				
M. strobilifera (L.) St. Hil. ex O. K. S, 10, 3	C				
Mucuna gigantea (Willd.) DC. C, 10(5)	C				C R
Pongamia pinnata (L.) Pierre T, 5	C	C			R
Pueraria phaseoloides (Roxb.) Benth. V, 10, 10	C				
Sophora tomentosa L. S, 5, ?, 1		R			C
Tephrosia sp. S, 8, 10, 10		C			
LENTIBULARIACEAE					
Utricularia cf. caerulea L. H, 3, 10	C				
LOGANIACEAE					
Fagraea ceilanica Thunb. S, 7, ?, 1	C				
F. fragrans Roxb. T, 9, 6,			C		
Mitrascme pygmaea R. Br. var. malaccensis (Wight) Hara H, 8, 6			C		
Strychnos axillaris Colebr. S, 7, 1	C				
S. sp. C, 9, ?, 2		C			

	T	A	R	D	G
LORANTHACEAE					
Dendropthoe pentandra (L.) Miq. P, 10(6), 1	C				
Loranthus pulcher DC. P			R		
Macrosolen cochinensis Tiegh P, 9, 3	C				
LYTHRACEAE					
Lagerstroemia cf. calyculata Kurz. DT, 9(7), 6	C				
L. cf. floribunda Jack 10, 6	C				
L. cf. ovalifolia T. et B. T, 10	C				
L. cf. siamica Gagnep. T, 5			C		
MALPIGHIACEAE					
Hiptage benghalensis (L.) Kurz C, 5, 1-2		C			
MALVACEAE					
Abelmoschus moschatus Medik S, 10, 10, 10	C				
Hibiscus macrophyllus Roxb. ex Horrem T, 10, 2	C				
H. surattensis L. S, 10, 12	C				
H. tiliaceus L. T, 1	C	C R	C		
Sida carpinifolia L. S, 10, 12	C				
Thespesia populnea (L.) Soland. ex Correa T, 1	C	C	C		
Urena lobata L. S, 10, 10, 10	C				
MELASTOMATACEAE					
Macrolenes nemorasa Bl. C, 10, 7	C				
Memecylon cantleyi Ridl. S, 9, ?, 2					C
M. caeruleum Jack S, 9(5)	C K	C K	C R		
M. edule Roxb. T	R	R			
M. garcinoides Bl. S	K				
M. oleiferum Bl. T	K				
M. pauciflorum Bl. S	R		R		
Oritrephes sp. T, 9, ?, 1	C				
Osbeckia chinensis L. H, 8, 6-10, 6-10		C	C		
Pternandra caerulescens Jack S, 9, 1	C K				
Sonerila tenera Royle H, 7, 10, 10	C				
S. sp. H, 8, 10		C			
MELIACEAE					
Aglaia sp. T, 9, ?, 3	C				
A. sp. T, 9, ?, 3	C				
Amoora sp. T, 9, ?, 3		C	C		
A. sp. T, 9	C				
Sandoricum koetjape Merr. T, dubiously wild	C				
Xylocarpus granatum Koen. T, 1	C				
X. moluccensis (Lamk.) Roem. T, 5(1), 1					C
MENISPERMACEAE					
Pericampylus glaucus (Lamk.) Merr. V, 10, 1	C				
Tiliacora triandra Diels V, 10, 2		C			
Tinospora sp. C, 5		C			
MORACEAE					
Artocarpus dadah Miq. T, 10, ?, 3	C				
A. rigidus Bl. T, 9, ?, 3	C	C			
Ficus annulata Bl. C, 9, 3	C				
F. benjamina L. T, 9, 3		C			
F. chartacea Wall. ex King S, 10	C	R	C	R	
F. consociata Bl. C, 5, 10	C				
F. curtipes Corner C, 1	C				
F. deltoidea E.	C		C		
F. fistulosa Reinw. ex Bl.T, 10	C				
F. geniculata Kurz T, 5	C	C	C		
F. globosa Bl. C, 9	C	C R			
F. hispida L. f. T, 10	C				
F. microcarpa L. f. T(S), 5(7)	C	C	C		
F. oligodon Miq. T, 9	C				
F. parietalis Bl. C		R			

	T	A	R	D	G
MORACEAE (cont.)					
Ficus cf. pellucido-punctuata Griff. T, 9	C		C		
F. retusa L. T		R			
F. rumphii Bl. T		C			
F. sagittata Vahl. C, 9	C				
F. superba Miq. T, 5	C				
F. variegata Bl. T, 10	C				
F. vasculosa Wall. ex Miq.	C				
Maclura cf. fruticosa (Roxb.) Corner			C		
Poikilospermum suaveolens (Bl.) Merr. C, 9	C	C			
Streblus asper Lour. S, 7	C				
S. cf. glaber (Merr.) Corner S, 7	C				
S. ilicifolia (Vidal) Corner S, 7(9), 2	C	C			
S. taxoides (Heyne) Kurz S, 9		C R	R		
MYRISTICACEAE					
Horsfieldia irya (Gaertn.) Warb. T, 1, 10-11, 3	C	C			
Knema furfuracea (Hk. f. et Thoms.) Warb. T, 9, 1	C				
K. globularia (Lamk.) Warbl. T, 9, 1-2, 2	C	C	C		
K. laurina (Bl.) Warb. T, 9, 1-2	C	C	C		
Myristica sp. T, 9, 2		C	C		
MYRSINACEAE					
Aegiceras corniculatum (L.) Blanco 1, 6	C K				
Ardisia crispa A. DC.		K			
A. littoralis Andr. T, 1	C K		C		
A. ridleyi King & Gamble T, 9	C	C	C		
A. stylosa Miq. T, 9, 11-12		C	C		
Maesa ramentacea Wall. T, 10, 8, 8	C K				
Myrsine porteriana Mez. T, 6(8)	C	C K			
MYRTACEAE					
Decaspermum fruticosum Forst. T, 10, 3	C				
Eugenia cerasiformis (Bl.) A. DC. T		K			
E. claviflora Roxb. T, 5, 10, 2	C	C	C		
E. grandis Wight T, 5	C	C	C		
E. operculata Roxb. T, 10, 3, 3	C				
E. pseudoformosa King T, 9, 2			C		
E. rhamphiphylla Craib T, 9, 2		C	C K		
E. scortechinii King, T			R		
E. siamensis Craib T, 9, 3	C				
E. spicata Lamk, T, 6(9)	C	C R			
E. syzigioides (Miq.) Hend. T, 5, 11			C		
Melaleuca cajuputi Powell T, 6	C				
Rhodamnia cinerea Jack T, 6(8)	C	C	C		
Rhodomyrtus tomentosa Wight S, 6(10)	C				
NYCTAGINACEAE					
Boerhavia diffusa L. H, 10(7)	C	C			
NYMPHACEAE					
Barclaya longifolia Wall. H, 3	C				
OCHNACEAE					
Gomphia serrata (Gaertn.) Kanis T, 9, 3-6	C		C		
Ochna integerrima (Lour.) Merr. T, 1, 2, 2	C		R		
OLACACEAE					
Anacolosa griffithii Mast. 9(5), 12-1	C	C			
Erythropalum scandens Bl. V, 7, 6	C				
Ximenia americana L. S, 5, ?, 2		C			
OLEACEAE					
Chionanthus calcicolus (Kerr) Kiew T, 7, 12(4)	C				
C. cf. ramiflorus Roxb. T, 7, 6	C				
Myxopyrum sp. C, 9		C			
Olea brachiata (Lour.) Merr. T, 5, 12		C			
O. dentata (Wall.) DC T, 6, 2	C				

	T	A	R	D	G
ONAGRACEAE					
Ludwigia perennis L. H	K				
L. prostrata Roxb. H	R				
OPILIACEAE					
Melientha suavis Pierre ssp. suavis T, 9, 1		C			
PASSIFLORACEAE					
Passiflora foetida L. V, 10	C	C			
PIPERACEAE					
Piper sp. C, 9	C				
P. sp. V, 9, ?, 7	C				
PITTOSPORACEAE					
Pittosporum ferrugineum Ait. T, 6, 11, 1	C	K	C		
PLUMBAGINACEAE					
Aegialites rotundifolia Roxb. S, 1	C				
POLYGALACEAE					
Salmonia cantoniensis Lour. H, 10(8)	C	C			
RANUNCULACEAE					
Clematis smilacifolia Wall. V, 9		C			
RHAMNACEAE					
Colubrina asiatica Brong. S, 5	C	C R	C		C
Gouania javanica Miq. C, 10, 1	C				
Ventilago sp. C, 9	C	C			
Zizyphus oenoplia (L.) Mill. S, 7, 10	C				
RHIZOPHORACEAE					
Bruguiera cylindrica (L.) Bl. T, 1	C	R			
B. gymnorrhiza Lamk. T, 1	C				
B. parvifolia (Roxb.) W. & A. ex Griff. T, 1	C				
B. sexangula (Lour.) Poir. T, 1	C				
Carallia brachiata (Lour.) Merr. T, 9(10), 2	C	C			
Ceriops decandra (Griff.) Ding Hou T, 1	C				
C. tagal (Perr.) C. B. Rob. T, 1	C	C			
Rhizophora apiculata Bl. T, 1	C	C			
R. mucronata Poir. T, 1	C	C	C K		
ROSACEAE					
Eriobotrya stipularis Craib T		K			
RUBIACEAE					
Anthocephalus chinensis (Lamk.) A. Rich ex Walp. T, 10, 7	C				
Argostemma cf. acuminatum King H, 7, 6-10, 6-10	C				
Borreria hispida Schum. H, 10	C				
Canthium dicoccum Merr. T, 7, 8	C	R		R	R
C. glabrum Bl. T, 9, ?, 2			C		
C. nitidum Kerr T		K			
C. umbellatum Wight					K
Chasalia curviflora Thw. S, 9, 3	C				
C. ophioxyloides Craib		K			
Gardenia coronaria Ham T, 10, 3, 3	C K				
Geophila repens (L.) I. M. Johnston H, 9, 11	C K				
Greenea corymbosa K. Schum T, 9, 6	C				
G. secunda (Griff.) Craib T, 8, 12		C K			
Guettarda speciosa L. T, 5	C	C	C		C
Hedyotis auricularia L. H, 9, 6		C			
H. congesta Wall. H		R	R		
H. cf. coronaria (Kurz) Craib H, 9, 10	C				
H. ovalifolia Cavan H, 7(9), 10	C	C			
H. philippensis (Willd.) Merr. ex C. B. Robinson 9, 6			C		
H. pinifolia Wall. ex G. Don H, 5, 10	C				

	T	A	R	D	G
RUBIACEAE (cont.)					
Hedyotis venosa Korth H	K				
Hedyotis cf. verticellata (L.) Lamk. H, 7, 6-10	C				
Hydnophytum formicarium Jack E, 9(5), 3	C	R	R	R	C
Hymenodictyon excelsum (Roxb.) Wall. DT, 7(8), 7	C	C			
Hypobathricum racemosum (Roxb.) Kurz. T, 10, 2	C				
Ixora brunonis Don S	R	R			
I. chinensis Lam. S			R		
I. javanica (Bl.) DC. S, 9, 2		K			
I. pendula Jack T	R				
I. umbellata Koordens et Valeton var. multibracteata Corner S, 9, 3	K	R	C		
Lasianthus cyanocarpus Jack		R			
L. subaureus Craib		K			
Morinda citrifolia L. T, 5	C	C	K		
M. elliptica L. T, 5		C			
M. umbellata L. T				K	
Mussaenda villosa Wall. C, 10	C	C	C		
Ophiorrhiza fontinalis Ridl. H				K	R
O. scabrella Ridl. S					R
Pavetta graciliflora Wall. ex Ridl. S, 9, 2		K	C		
P. indica L.	R	R			
P. indica L. var. canescens (Wall.) Ridl.	C				
P. naucleiflora Wall. S, 7, 11	C				
P. sp. S, 9, 6			C		
P. sp. S, 9, 12, 12	C				
P. sp. S, 9, 6			C		
Prismatomeris malayana Ridl. S, 10, 3	C	R	K		
Psychotria sarmentosa Bl. V, 9, 2	C	C			
P. sarmentosoides Val.		K			
P. serpens L.		K			
P. stipulacea Wall.			R		
P. viburnifolia Craib		K			
Randia densiflora Benth. Var. parvifolia King T			R		
R. exaltata Griff. T		R K	R		
R. longiflora Lam. S, 1, 1	C				
R. oppositifolia Koord.		K			
R. parvula Ridl. S		R K	R		
Saprosma sp. S, 9, 2		C			
Scyphiphora hydrophyllacea Gaertn. T, 1	C				
Tarenna adangensis Ridl. S		R	R		
T. costata Merrill		K			
T. curtisii Ridl. S	R				
T. hispidula Kerr			R		
T. insularis Ridl. S		R			
T. stellulata Ridl.					R
T. wallichii Ridl.		K			
Timonius cf. wallichianus (Korth.) Val. T, 10, 6			C		
Uncaria lanosa Wall. C	K				
U. sclerophylla Roxb. C, 10	C K				
Urophyllum glabrum Wall. S		C			
RUTACEAE					
Atalantia monophylla DC. T, 9(5), 12	C	C			
Citrus macroptera Montrouzier T, dubiously wild	C				
Clausena excavata Burm. f. T, 10, 3	C				
Glycosmis chlorosperma Spr. S, 6, 11	C				
G. pentaphylla (Retz.) Corr. S, 9, 2	C				
G. rupestris Ridl. S, 7	C	R	R		C
G. sapindoides Lindl. ex Wall S, 9, 2			C		
Luvunga eleuranthera Dalz. C, 9, ?, 1	C				
L. scandens Ham. C, 9		C			
Micromelum falcatum (Lour.) Tagaka T, 10, 3	C				
Murraya paniculata (L.) Jack S, 7, 3	C				
Paramignya lobata Burkill C, 9, 7, 1		C			
Zanthoxylum rhetsa (Roxb.) DC. T, 10	C	C			
SANTALACEAE					
Scleropyrum wallichianum (Wight et Arn.) Arn., T, 9, 11-2, 6	C	C			

	T	A	R	D	G
SAPINDACEAE					
Allophylus cobbe Bl. S, 5, ?, 1	C				
A. ternatus Lour. S, 1, 6	C				
Dodonea viscosa Jacq. S, 5, 12, 12	C	C			
Guioa squamosa Radlk. T, 9, 10		C			
Lepisanthes fruticosa (Roxb.) Leenh. S, 9, 2, 2		C	C		
L. rubiginosa (Roxb.0 Leenh. T, 9(10), 1	C				C
L. tetraphylla (Vahl) Radlk. T, 7, 2, 2	C R				
Mischocarpus sundaicus Bl. T, 6, 7	C				
Nephelium longana Craib T	R K				
Xerospermum sp. T, 9, 2, 3		C	C		
SAPOTACEAE					
Palaquium obovatum (Griffith) Engler T, 9, 11-12			C		
Payena lanceolata Ridl. T, 9, 2			C		
P. punctata Fletcher T		K			
Planchonella obovata (R. Br.) Pierre T, 5	C	C R			
Sideroxylon ferrugineum Hook. f. T		R			
SAXIFRAGACEAE					
Polyosma adangensis Craib T		K			
P. conocarpa Ridl. T	K				
SCROPHULARIACEAE					
Adenosma caeruleum R. Br. H, 10, 10	C				
A. hirsutum Kurz H, 6, 6-10	C				
Limnophila aromatica (Lamk.) Merr. H, 3, 1	C				
Lindernia pedunculata (Benth.) Wettst. H	R				
Torenia flava Buch.-Ham. ex Bth. H, 9, 11	C				
T. cf. edentula Griff. H, 9, 10		C			
SIMAROUBACEAE					
Brucea javanica (L.) Merr. S	K				
Eurycoma longifolia Jack T, 9, 2		C			
SOLANACEAE					
Physalis minima L. H, 7(10), 10, 10	C	C			
SONNERATIACEAE					
Sonneratia caseolaris (L.) Engl. T, 1, 4	C				
S. griffithii Kurz T, 1, 6, 6	C				
STERCULIACEAE					
Helicteres hirsuta Lour. S, 10		C	R		
H. obtusa Wall. T, 8, 10, 10		C R	R		
Heritiera littoralis Dryand T, 1(5)	C				
H. sumatrana (Miq.) Kosterm. T, 9, ?, 6		C	C		
H. sp. S, 1	C				
Pterospermum acerifolium (L.) Willd. T, 9, 3	C				
P. lancaefolium Roxb. T, 9, 6, 6		C			
Pterygota alata (Roxb.) R. Br. T, 9, ?, 2		C			C
Sterculia coccinea Jack S, 9, 2.		C R			
S. cordata Bl.	R	C			
S. cf. elongata S, 9, ?, 3			C		
S. foetida L. T, 5, ?, 1	C				
S. lancaviensis Ridl. T	R				
S. macrophylla Vent. T, 9, ?, 8	C				
S. sp. "C" See Tree Flora Malaya I, p. 378			C		C
S. sp. DT, 7, 1	C				
STYRACACEAE					
Styrax serrulatum Roxb. var. rugosum V. st. T, 9, 3	C				
SYMPLOCACEAE					
Symplocos cf. henschelii (Mor.) Benth. ex Clarke T, 9, 8	C				
S. celastrifolia Griff. ex Clarke T	K				

	T	A	R	D	G
THEACEAE					
Adinandra integerrima T. Anders. ex Dyer T, 10, 7	C				
Eurya acuminata DC. var. acuminata T, 10	C				
Schima wallichii (DC.) Korth T, 10, 10	C		?		
Ternstroemia wallichiana (Griff.) Engler T, 9, ?, 1	C				
TILIACEAE					
Berrya cordifolia (Willd.) Burret T, 5, ?, 7	C				
Colona merguensis (Planch. ex Mast.) Burret, T, 7, 7, 8	C				
Corchorus aestuans L. S, 7, ?, 8	C				
Grewia acuminata Juss. C, 10(7), 3(8)	C		C		
Grewia paniculata Roxb. ex DC. 10	C				
G. viminea Wall. ex Burret S, 7, 6, 6	C				
Schoutenia curtisii Roehm Hartano T, 7	C				
Trichospermum javanicum Bak. T, 10, ?, 1	C				
Triumfetta rhomboidea Jacq. S, 5, 11	C				
ULMACEAE					
Celtis philippensis Blanco T, 7, ?, 1	C				
Gironniera nervosa Planch. T, 10, ?, 6		C	C		
Trema tomentosa (Roxb.) Hara T, 10	C				
UMBELLIFERAE					
Oenanthe javanica DC. H, 10, 2	C				
URTICACEAE					
Elatostema sp. H, 9, 10		C			
VERBENACEAE					
Avicennia alba Bl. T, 1, 2	C				
A. marina (Forsk.) Vierch. T, 1, 7	C				
A. officinalis L. T, 1, 2	C				
Callicarpa longifolia Lam. T, 10, 6	C				
Clerodendrum indicum (L.) O. K. S, 10, 11	C				
C. inerme Benth. S, 1(5)	C	C			
C. langkawiense King & Gamble S	R				
C. cf. lloydianum Craib S, 10, 2		C			
C. paniculatum L. S, 7, 7	C				
C. villosum Bl. 10, 3	C				
Glossocarya premnoides Ridl. C, 5, 12-1					C
Gmelina elliptica J. E. Smith T, 10, 3, 3	C				
Peronema canescens Jack T, 10	C				
Premna corymbosa Rottl. et Willd. S, 5		C			
P. parasitica Bl. C		R			
P. tomentosa Willd. T, 10, 6-8	C				
Sphenodesme microstylis Clarke C	R				
S. pentandra Jack C, 10(9)	C	C	C		
Stachytarpheta indica L. 5(10)	C				
Vitex glabrata R. Br. T, 7, 6	C				
V. negundo L. S, 5, 8-10	C	C			
V. pinnata L. T, 10		C			
V. quinata (Lour.) F. N. Williams T, 10, 2, 2		C			
V. siamica R. N. Will. T, 7, 7	C				
VIOLACEAE					
Rinorea benghalensis (Wall.) O. K.	R				
R. horneri (Korth.) O. K. S, 9, 1, 1	C				
R. longiracemosa (Kurz) Craib S, 10, ?, 2	C				
R. macrophylla (Decne) O. K.		R			
VITACEAE					
Ampelocissus harmandii Ridl. V, 7, 6	C				
Cayratia geniculata (Bl.) Gagnep. V, 9, 3, 6		C			
C. sp. V, 7	C				
Cissus cf. assamica Craib V, 5, ?, 9		C			
C. hastata Miq. V, 10, ?, 2	C K	C			
C. pyrrhodasys (Miq.) Ridl. V, 1, 7, 7	C				
Vitis discolor Dalz. V, 7, 11	C	R			

Monocotyledons

	T	A	R	D	G
AGAVACEAE					
Dracaena aurantica Wall.		R	R		
D. congesta Ridl					R
Pleomele sp. V, 10, 9, 1, 1		C			
AMARYLLIDACEAE					
Crinum asiaticum L. H, 5	C	C			
Molineria latifolia Herv. ex Kurz H, 9	C	C R			
ARACEAE					
Aglaonema nitidum (Jack) Kunth H, 9, 8-12	C	C			
A. simplex Bl. H, 9, 8	C				
Alocasia denudata Engl. H, 9, ?, 8			C		
Amorphophallus haematospadix Hook. f. H, 7	C				
A. variabilis Bl. H	C				
A. viridis Ridl. H					R
Arisaema fimbriatum Masters H, 7, 6	C				
A. kunstleri King H		R			
A. roxburghii Kunth H		R			
Colocasia gigantea Hook. f. H, 7(9)	C		R		
Scindapsus sp. V, 9, 1		C			
BURMANNIACEAE					
Burmannia coelestis Don H, 6(3), 11	C				
B. lutescens Becc. H	R				
B. sp. H, 9, 10		C			
B. sp. H, 9, 10		C			
COMMELINACEAE					
Commelina sp. H, 6, 10	C				
CYPERACEAE					
Carex indica L.		C	R		
C. tricephala Boeck. H, 7	C				
Cyperus diffusus Vahl	C				
C. distans L. f.	C				
C. haspan L.	C				
C. pedunculatus (R. Br.) Kern	C	C R			
C. radians Nees & Meyer H, 4	C				
C. trialatus (Boeck.) Kern H, 10	C				
Eleocharis dulcis (Burm. f.) Henschel H, 3	C				
Fimbristylis dichotoma (L.) Vahl.	C				
F. dura (Zoll. & Mor.) Merr.	C		R		
F. ferruginea (L.) Vahl.	C				
F. eragrostis (Nees) Hance	C				
F. paucjflora R. Br.		C			
F. thouarsii (Kth.) Merr. ssp. filiformis (Thw.) T. Koyam.		C			
F. umbellaria Lamk.	C				
Fuierena umbelluata Rottb. H, 3	C				
Hypolytrum nemorum (Vahl.) Spreng var. nemorum		C	C		
Lepironia articulata (Retz.) Domin. H, 3	C				
Lipocarpha chinensis (Osb.) Kern H, 3	C				
Mapania tenuiscapa Clarke H,			R		
Mariscus compactus (Retz.) Bold.		C			
M. dubius (Rottb.) P. B.	C				
M. sumatrensis (Retz.) T. Koyam.	C				
Pycreus polystachyos (Rottb.) P. B.	C				
Rhynchospora cf. corymbosa (L.) Britt. H, 6	C				
Scleris levis Retz.	C				
S. purpurescens Steud.	C		C		
S. terrestris (L.) Fassett		C			
DIOSCOREACEAE					
Dioscorea sp. V, 7(9), 9-10, 6	C	C			
D. sp. V, 10, ?, 10	C				
D. sp. V, 9, 10		C			
D. sp. V, 9, 10	C				

	T	A	R	D	G
ERIOCAULACEAE					
Eriocaulon glabrifolium Ridl. H, 3	C				
E. sexangulare L. H, 3	C				
FLAGELLARIACEAE					
Flagellaria indica L. V, 1	C	C	C		
GRAMINEAE					
Acroceras tonkinense (Balansa) C. E. Hubbard ex Bor H			R		
Arundinella setosa Trin. H, 8			C		
Brachiara distachya (L.) Stapf. 10	C				
Cenchrus echinatus L. H, 10		C			
Centotheca lappaceum (L.) Desv. H, 9	C	C			
C. cf. longilamina Ohwi	C				
Cymbopogon calcicola Hubbard H, 8		C	R		
Dactyloctenium aegyptium (L.) P. Beauv. H, 10	C				
Dendrocalamus dumosus (Ridl.) Holttm. bamboo, 8, 2		C	C R		
D. sp. bamboo, 8, 10		C			
Dimeria ornithopoda Trin. H, 10	C				
Dinochloa scandens (Bl.) O. Ktze. climbing bamboo	C	C			
Eleusine indica (L.) Gaertn. H, 10	C				
Eremochloa bimaculata Hack. H, 8			C		
Imperata cylindrica (L.) Raeusch H, 10	C				
Ischaemum indicum (Houtt.) Merr. H, 6	C				
I. muticum L. H, 5	C	C R	C		C
Neyraudia reynaudiana (Kunth(Keng ex Hitch H, 10	C		C		
Oplismenus compositus (L.) Beauv. H, 10	C	R			
Paspalum conjugatum Berg. H, 3	C				
P. longifolium Roxb. H, 3	C				
Rhynchelytrum repens (Willd.) C. E. Hubbard H, 10	C				
Sacciolepis indica (L.) Chase H, 6(3)	C				
Schizostachyum insulare Ridl. bamboo			R		
Sporobolus harmandii Henr. H, 6	C R				
Thuarea involuta (Forst.) R. Br. H, 4	C	C R	C		
Thysanolaena maxima (Roxb.) O. Kuntze H, 10	C				
Zoysia matrella (L.) Merr. H, 1	C				
LILIACEAE					
Dianella ensifolia (L.) DC. H, 6(8), 6-10, 6-10	C		C		
Peliosanthes teta Andr. H, 9		C R	C R		
MARANTACEAE					
Donax cannaeformis (G. Forst.) K. Schum. S, 9, 2-3	C				
MUSACEAE					
Musa cf. acuminata Colla H, 10	C				
M. malaccensis Ridl. H, 10					R
ORCHIDACEAE					
Acampe longifolia Lindl.	R				
Aerides odoratum Lour. H, 5, 6			C		
Bulbophyllum corolliferum J. J. Sm. E, 11	C				
B. macranthum Lindl.		R			
Calanthe vestita Lindl.		R			
Ceratostylis subulata Bl.		R			
Corymbis veratrifolia Bl.		R			
Dendrobium indivisum (Bl.) Miq.	R				
D. lamellatum Lindl.			R		
D. secundum Lindl.		R			
Eria cristata Ridl.	R				
E. floribunda Lindl.	R				
E. tomentosa (Retz.) Hook. f. H, 9			C		
Eulophia graminea Lindl. H, 5, 2		C R			
E. keithii Ridl.				R	R
Geodorum purpurea Br.			R		
Habenaria carnea N. E. Br. H, 7, 6-10	C				
H. goodyeroides Don H, 7, 6-10	C				
Nervila aragoana Gaud.		R			
N. punctata (Bl.) Schltr.	R				

	T	A	R	D	G
ORCHIDACEAE (cont.)					
Paphiopedilum niveum Pfitzer H, 7, 6-10	C				
Podochilus cf. microphyllus Lindl. E		C			
Trichoglottis fasciata Rchb. f.	R				
T. misera (Ridl.) Holttm.		R	R		
Vandopsis gigantea (Lindl.) Pfitz.	R				
PALMAE					
Areca triandra Roxb. T, 9, 1	C	C	R		
Caryota mitis Lour. T, 9(7)	C	C	C		C
Cocos nucifera L. T, 5	C	C	C		
Korthalsia sp. C, 9	C	C	C		
Licuala peltata Roxb. S, 9, 1	C				
L. spinosa Wurmb.			R		
Livistona saribus Merr. T, 9(8)	C		C		
Nenga cf. macrocarpa Scort. T, 9	C				
Nypa fruticans Wurmb. S, 1	C				
Oncosperma horrida Scheff. T, 9			C		
O. tigillaria (Jack) Ridl. T, 1	C	C	R		
Orania sylvicola (Griff.) Moore T, 9, ?, 10	C	C			
Pinanga adangensis Ridl. T, 9(2), ?, 4	C	R	C		
Plectocomia griffithii Becc. C, 9			C		
Salacca conferta Griff. S, 2	C	C			
S. rumphii Wall. T, 9	C				
PANDANACEAE					
Freycinetia sumatrana Hensley C, 9, ?, 1		C	C		
F. sp. C, 9		C			
Pandanus odoratissimus L. f. S, 5	C	C	C		
P. cf. toei St. John S, 10	C				
P. sp. T, 2	C	C			
SMILACACEAE					
Smilax cf. blumei A. DC. C, 10, ?, 3	C				
S. sp. V, 9, 1					C
STEMONACEAE					
Stemona tuberosa Lour. V, 7, 6-10	C		R		
TACCACEAE					
Tacca chantrieri Andr. H			R		
T. leontopetaloides (L.) O. K. H, 7, 6-10, 6-10	C				
XYRIDACEAE					
Xyris cf. complanata R. Br. H, 6	C				
X. indica L. H, 3	C				
ZINGIBERACEAE					
Achasma megalocheilos Griff. H, 9	C				
Ammomum cf. aculeatum Roxb. H, 9, ?, 7	C				
A. biflorum Jack H			R		
A. hastilabium Ridl. H, 9, 3	C				
Boesenbergia curtisii (Bak.) Schl. H, 7, 6-12, 6-12	C				
Catimbium latilabre (Ridl.) Hollt. H, 10, 3	C				
Costus speciosus Sm. H, 9	C	C			
Globba leucantha Miq. var. bicolor Hollt. H, 9(8), 6-11, 6-11		C	C		
G. sp. H, 7, 6-9, 6-9	C				
G. sp. H, 9, 7, 7	C				
Kaempferia pulchra Ridl. H, 7, 6-10, 6-10	C				
Zingiber cf. ottensii Valeton H, 9, 7, 7	C				
Z. spectabile Griff. H, 9, 3	C				
Z. zerumbet (L.) Sm. H, 9, 3, 3	C				

APPENDIX 2.

MANGROVE AND BRACKISH WATER PLANTS

ACANTHACEAE
Acanthus ilicifolius L.

APOCYNACEAE
Cerbera odollam Gaertn.

ASCLEPIADACEAE
Finlaysonia obovata Wall.

BIGNONIACEAE
Dolichandrone spathacea (L. f.) K. Schum.

CELASTRACEAE
Cassine viburnifolia (Juss.) Hou

COMBRETACEAE
Lumnitzera littorea (Jack) Voight
L. racemosa Willd.

COMPOSITAE
Pluchea indica (L.) Less
Wedelia biflora DC.

EBENACEAE
Diospyros ferrea (Willd.) Bakh.

EUPHORBIACEAE
Excoecaria agallocha L.

LEGUMINOSAE
Caesalpinia crista L.
Cynometra ramiflora L.
Dalbergia candenatensis (Dennst.) Prain
Derris cf. heptaphylla (L.) Merr.
Desmodium umbellatum DC.
Intsia bijuga (Colebr.) O.K.
Peltophorum pterocarpum (DC.) Back.

MALVACEAE
Hibiscus tiliaceus L.
Thespesia populnea (L.) Soland. ex Correa

MELIACEAE
Xylocarpus granatum Koen.
X. moluccensis (Lamk.) Roem.

MORACEAE
Ficus curtipes Corner
F. microcarpa L. f.

MYRISTICACEAE
Horsfieldia irya (Gaertn.) Warb.

MYRSINACEAE
Aegiceras corniculatum (L.) Blanco
Ardisia littoralis Andr.

PLUMBAGINACEAE
Aegialites rotundifolia Roxb.

RHIZOPHORACEAE
Bruguiera cylindrica (L.) Bl.
B. gymnorrhiza Lamk.
B. parvifolia (Roxb.) W. & A. ex Griff.
B. sexangula (Lour.) Poir
Ceriops decandra (Griff.) Hou
C. tagal (Perr.) C. B. Rob.
Rhizophora apiculata Bl.
R. mucronata Poir.

RUBIACEAE
Randia longiflora Lam.
Scyphiphora hydrophyllacea Gaertn.

SAPINDACEAE
Allophylus ternatus Lour.

SONNERATIACEAE
Sonneratia caseolaris (L.) Engl.
S. griffithii Kurz

STERCULIACEAE
Heritiera littoralis Dryand
H. sp.

VERBENACEAE
Avicennia alba L.
A. marina (Forssk.) Vierh.
A. officinalis L.
Clerodendrum inerme Benth.

CYPERACEAE

Eleocharis dulcis (Burm. f.) Henschel

Mariscus javanicus (Houtt.) Merr. & Metcalfe

FLAGELLARIACEAE

Flagellaria indica L.

GRAMINEAE

Zoysia matrella (L.) Merr.

PALMAE

Nypa furticans Wurmb.

Oncosperma tigillaria (Jack) Ridl.

PANDANACEAE

Pandanus odoratissimus L. f.

PTERIDOPHYTES

Acrostichum aureum L.

APPENDIX 3.

PLANTS ON LIMESTONE

ACANTHACEAE
Gymnostachyum decurrens Stapf
Justicia sp.
Pseuderanthemum graciliflorum Ridl.

ANACARDIACEAE
Pentaspadon curtisii (King) Corner
Semecarpus sp.

ANNONACEAE
Cananga cf. latifolia (Hk. f. et Th.) Finet et Gagnep. +
Enicosanthum cf. congregatum (King) Airy Shaw

ASCLEPIADACEAE
Ceropegia cf. langkawiensis Rintz. +
Sarcostemma brunonianum Wight & Arn. +
Raphistemma pulchellum Wall. +
Secamone micrantha Dcne.

BALSAMINACEAE
Impatiens mirabilis Hook. f. *

BEGONIACEAE
Begonia cf. phoeniogramma Ridl. *

BIGNONIACEAE
Stereospermum fimbriatum (Wall. ex G. Don) A. DC.

BOMBACEAE
Bombax anceps Pierre

CAPPARIDACEAE
Capparis sepiara L. +

COMBRETACEAE
Terminalia calamansanai (Blanco) Rolfe
T. cf. nigrovenulosa Pierre ex Laness. +
T. triptera Stapf.

COMPOSITAE
Mikania cordata (Burm. f.) B. L. Robins.
Vernonia cinerea (L.) Less
V. curtisii Craib

DIPTEROCARPACEAE.
Hopea ferrea Laness.
Shorea siamensis Miq.
EBENACEAE
Diospyros bejaudii Lec. +
D. umbellata Wall. ex G. Don
EUPHORBIACEAE
Claoxylum imdicum (Reinw. ex Bl.) Hassk. +
Croton cascarilloides Raeusch
Drypetes hoaensis Gagnep. +
Euphorbia antiquorum L. *
Leptopus australis (Zoll. et Mor.) Pojark. *
Mallotus dispar (Bl.) M. A.
Phyllanthus columnaris M. A.
Sapium insigne (Royle) Benth.
Sauropus villosus (Blanco) Merr.
FLACOURTIACEAE
Homalium caryophyllaceum (Z. & M.) Benth. +
Hydnocarpus ilicifolius King *
GESNERIACEAE
Chirita rupestris Ridl. *
Monophyllaea glabra Ridl. *
Paraboea sp.
Paraboea sp.
Paraboea sp.
LEEACEAE
Leea rubra Bl.
LEGUMINOSAE
Bauhinia curtisii Prain +
Desmodium rugosum Prain
Erythrina orientalis (L.) Merr.
LOGANIACEAE
Fagraea ceilanica Thunb.
Strychnos axillaris Colebr.
LYTHRACEAE
Lagerstroemia sp. +

MELASTOMATACEAE
Sonerila tenera Royle. *

MENISPERMACEAE
Tiliacora triandra Diels.

MORACEAE
Ficus microcarpa L. f.
Streblus asper Lour.
S. ilicifolius (Vidal) Corner

NYCTAGINACEAE
Boerhavia sp.

OLACACEAE
Erythropalum scandens Bl. +

OLEACEAE
Chionanthus calcicolus (Kerr) Kiew

RHAMNACEAE
Zizyphus oenoplia (L.) Mill.

RUBIACEAE
Argostemma sp.
Canthium dicoccum Merr.
Hedyotis ovalifolia Cavan. +
H. cf. verticillata (L.) Lamk.
Hymenodictyon excelsum (Roxb.) Wall.*
Pavetta naucleiflora Wall.

RUTACEAE
Glycosmis rupestris Ridl.
Murraya paniculata (L.) Jack

SAPINDACEAE
Lepisanthes tetraphylla (Vahl.) Radlk. *

SOLANACEAE
Physalis minima L.

STERCULIACEAE
Sterculia sp.

TILIACEAE
Grewia acuminata Juss.
G. viminea Wall. ex Burrett *
Colona merguensis (Planch. ex Mast.) Burrett *
Schoutenia cf. curtisii Roehm. Hartono +

ULMACEAE
Celtis philippensis Blanco *

VERBENACEAE
Clerodendrum paniculatum L.
Vitex glabrata R. Br.
V. siamica F. N. Williams *

VITACEAE
Ampelocissus harmandii Ridl.
Cayratia sp.
Cissus pyrrhodasys (Miq.) Ridl.
Vitis discolor Dalz.

ARACEAE
Alocasia denudata Engl.
Amorphophallus haematospadix Hook. f.
Arisaema fimbriatum Masters *
Colocasia gigantea Hook. f.

CYPERACEAE
Carex tricephala. Bock +

DIOSCORACEAE
Dioscorea sp.

GRAMINEAE
Coelorachis glandulosa (Trin.) Stapf. ex Ridl. +

ORCHIDACEAE
Habenaria carnea N. E. Br. *
H. goodyeroides Don
Paphiopedilum niveum Pfitz. *

PALMAE
Caryota mitis Lour.

STEMONACEAE
Stemona tuberosa Lour.

TACCACEAE
Tacca leontopetaloides (L.) O. K.

ZINGIBERACEAE
Boesenbergia curtisii (Bak.) Schl. *
Globba sp.
Kaempferia pulchra Ridl. *

PTERIDOPHYTES

Adiantum malesianum Ghatak

Antrophyum callifolium Bl.

Asplenium adiantoides (L.) C.

Doryopteris ludens (Wall.) J. Sm. *

Drynaria rigidula (Sw.) Bedd.

Pyrrosia adnascens (Forst.) Ching

P. stigmosa (Sw.) Ching *

Tectaria variolosa (Wail. ex Hk.) C. Chr.

+ not recorded by CHIN (1973, 1977, 1979) as occurring on limestone

* restricted to limestone according to CHIN

APPENDIX 4.

CULTIVATED AND/OR INTRODUCED PLANTS

ACANTHACEAE
Seriocalyx schomburgkii (Craib) Brem.

ANACARDIACEAE
Anacardium occidentale L.
Mangifera foetida Lour.
M. indica L.

ANNONACEAE
Annona muricata L.
A. reticulata L.
A. squamosa L.

APOCYNACEAE
Allamanda cathartica L.
Catharanthus roseus (L.) G. Don
Ervatamia coronaria Stapf.

BIGNONIACEAE
Tecoma stans (L.) H. B. K.

BOMBACACEAE
Ceiba pentandra Gaerrtn.
Durio zibethinus L.

CONVOLVULACEAE
Ipomea batatas Lam.
I. aquatica Forsk.
I. aquatica, white-flowered form

EUPHORBIACEAE
Euphorbia heterophylla. L
E. hirta L.
Hevea brasiliensis (Willd. ex A. Juss.) M. A.
Manihot esculenta Crantz.
Ricinus communis L.

LABIATAE
Ocimum tenuiflorum L.

LEGUMINOSAE
Cassia alata L.
Centrosema pubescens Bth.
Enterolobium saman Prain
Gliricidia sepium Steud.
Leucaena glauca Benth.
Tamarindus indica L.

MALVACEAE

Abelmoschus esculentus Moench.

Gossypium sp.

MORACEAE

Artocarpus heterophyllus Lamk.

A. altilis Fosberg

A. integer Merr.

MORINGACEAE

Moringa oleifera Lamk.

MYRTACEAE

Psidium guajava L.

RHAMNACEAE

Zizyphus jujuba Mill.

RUTACEAE

Citrus aurantifolia (Christm.) Swingle

C. grandis (L.) Osbeck

C. hystrix DC.

C. limon (L.) Burm. f.

SAPOTACEAE

Achras sapota L.

SOLANACEAE

Capsicum frutescens L.

TILIACEAE

Muntingia calabura L.

VERBENACEAE

Clerodendrum splendens G. Don

Lantana camara L.

GRAMINEAE

Cymbopogon citratus (DC.) Stapf.

MUSACEAE

Musa sp.

PALMAE

Areca catechu L.

Cocos nucifera L.

ZINGIBERACEAE

Curcuma zeodaria (Berg.) Stapf.