

**REPORT ON
THE FLORA OF THAILAND PROJECT – I. EXPEDITION**

by

KAI LARSEN and ESBERN WARNCKE
Botanical Institute, University of Aarhus, Denmark.

Introduction

During the nine years the senior author has worked in Thailand the plan of a flora of the country has gradually developed. Three years ago the plan was discussed with Mr. TEM SMITINAND from the Royal Forest Department and in 1965 a working group was set up after a conference in London. For further information see LARSEN & SMITINAND (1966). In 1966 an expedition was undertaken for three purposes, (1) to collect supplementary material of those groups which are supposed to be treated first in the flora, (2) to visit some areas where few or no collections had been made before, (3) to start cytotaxonomical studies on Thai bryophytes. The members of the expedition were Professor KAI LARSEN, Mr. E. WARNCKE, B.A., from Denmark, and Mr. TEM SMITINAND, representing the Royal Forest Department in Thailand. Besides, some young forest officers took part in the work from time to time.

The expedition was financed through a grant from the Danish Secretariate for Technical Co-operation with the Developing Countries. We want to express our deepest gratitude for the understanding our project has met with within the Board of Directors of the Secretariate. Also from other quarters the expedition has received support. Thus the East Asiatic Company has given free carriage by sea of all material sent to and from the expedition. We are most grateful for this help. The Botanical Institute, Aarhus University, has supplied all collecting material and most of the other equipment, and finally the Royal Forest Department has placed a landrover at our disposal and arranged all the stays at the forestry stations.

As always, the headquarters of the expedition were the Royal Danish Embassy in Bangkok, where H.E. Mr. EBBE MUNCK with his usual kindness and friendship helped us in every way. We want to

express our most hearty thanks to him and his collaborators in the Embassy.

The main set of the collections is deposited at Herbarium AAU (Aarhus) while a set (which may be regarded as nearly complete) is deposited in Herbarium BKF (Bangkok).

In order to facilitate the work for future monographers who may deal with the material, a map of Thailand is enclosed, showing the areas visited and the route of the expedition. For the names in the Khao Yai and Chantaburi areas see also LARSEN (1964a). For the Thung Salaeng Luang area see SEIDENFADEN (1964).

Itinerary and Collection Numbers

1966

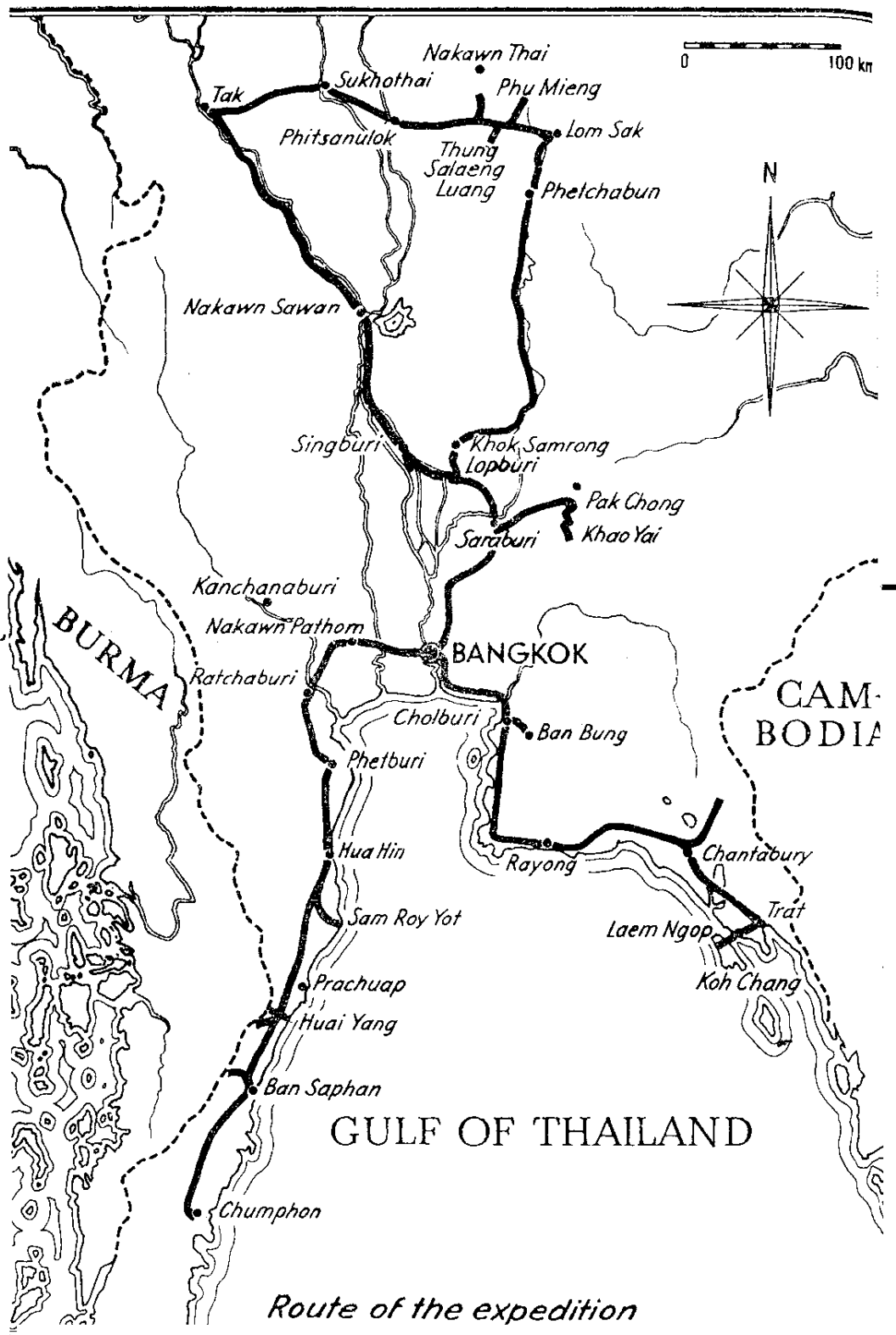
7.7. Khao Yai	1 - 93
8.7. Khao Yai (Heo Suwat Falls)	94 - 143
9.7. Khao Yai	144 - 193
10.7. Khao Yai	194 - 256
11.7. Khao Yai	257 - 302
12.7. Khao Yai	303 - 370
13.7. Khao Yai	371 - 410
14.7. Foothills of Khao Yai and Muak Lek	411 - 429
16.7. Bangkok	430 - 455
17.7. Bangkok	456
19.7. Thung Salaeng Luang	457 - 551
20.7. Thung Salaeng Luang	552 - 629
21.7. Thung Salaeng Luang	630 - 697
22.7. Thung Salaeng Luang	698 - 755
23.7. Thung Salaeng Luang	756 - 808
24.7. Thung Salaeng Luang	809 - 872
25.7. Thung Salaeng Luang	873 - 922
26.7. Thung Salaeng Luang	923 - 924
27.7. Foothills of Phu Mieng Mountain	925 - 948
28.7. Phu Mieng Mountain	949 - 1088
29.7. Phu Mieng Mountain	1089 - 1106
31.7. Nakawn Sawan	1107 - 1113
2.8. Cholburi	1114 - 1164
4.8. Bangkok	1116 - 1167
6.8. Sam Roy Yot	1168 - 1211
7.8. Sam Roy Yot	1212 - 1250
8.8. Sam Roy Yot and Prachuap	1251 - 1275

9.8. Huai Yang	1276 - 1351
10.8. Khao Nam Tok	1352 - 1428
11.8. Chumphon	1429 - 1499
12.8. Huai Yang	1500 - 1537
13.8. Ban Saphan	1538 - 1585
14.8. Huai Yang	1586 - 1613
15.8. North of Hua Hin	1614 - 1622
21.8. Khao Sabab, Pniu Falls	1623 - 1660
22.8. Plain of Makam	1661 - 1753
25.8. Island of Koh Chang	1754 - 1829
26.8. Plain of Makam	1830 - 1872

Comments on the Itinerary

As appears from the Itinerary the first place visited was the Khao Yai National Park. A description of this area has already been given by LARSEN (1964a), and we have little to add to the general description. One day was spent at the top of Khao Khieo, where collections were made particularly in open sandstone areas in the evergreen forest. This locality rich in *Sphagnum* and mosses has previously been visited in the dry season by the 4th Thai-Danish Botanical Expedition, it was therefore extremely interesting to analyse the flora during the rainy season. Besides a rich flora of mosses a luxuriant vegetation of *Cyperaceae* and grasses was found; character species which ought to be mentioned are *Burmannia disticha* and *Murdania gigantea*, furthermore species of *Eriocaulon* and *Utricularia*. All these plants are also common on the sandstone plateau-mountains in N.E. Thailand, e.g. Phu Krading. The area with this vegetation is very limited and on the margin a scrub vegetation with *Melastoma* sp., *Osbeckia* sp., *Rhamnus cambodiana*, and others is found. This vegetation gradually changes into a humid evergreen hillside forest rather rich in humus.

The other six days at Khao Yai were spent collecting in the evergreen forests between 700 and 900 m. A highly varied vegetation occurs there, particularly along streams and small waterfalls. A number of *Liliaceae* were sent back to Aarhus for cultivation experiments. It should be added that a species quite new to this area, *Sambucus javanica*, was observed as rather common about the altitude



Route of the expedition

of 700 m. On the way back to Bangkok from this trip we stopped at the foothills of Khao Yai where low limestone outcrops are still found with more or less natural vegetation on the top. Unfortunately time did not allow a longer stay there. As far as we know, collection has never been undertaken in the limestone area of the foothills of Khao Yai; this ought to be done before the flora disappears completely.

The next area visited was the Thung Salaeng Luang National Park and the Phu Mieng Mountain situated outside the park. These two areas will be dealt with separately.

The Thung Salaeng Luang National Park was visited during a short stay in the dry season by the 4th Thai-Danish Botanical Expedition (SEIDENFADEN, 1964). According to information I have obtained from Mr. BERTEL HANSEN, Copenhagen, this area might be extremely interesting during the rainy season as nobody had ever collected plants here. Therefore a week was reserved for a closer study of the forest in this newly established nature reserve.

The whole Thung Salaeng Luang National Park is situated in an area with evergreen forest at an altitude of 700 to 1100 m. Some few trails run through the forest, and it was thus possible for us during the short stay to get a rough idea of the vegetation and its composition. It should, however, be emphasized that only a very small part of the flora of this area is known so far, even after our collections, and it would certainly be worth while to follow the vegetation during the whole year as was done during the 1st Thai-Danish Botanical Expedition in 1957 on Doi Sutep, North Thailand. About 400 collections were undertaken in a flora which is certainly composed of about 2000 species. There is no doubt that among the *Zingiberaceae*, *Liliaceae* and *Acanthaceae* there will be a number of undescribed species.

The *Zingiberaceae*, to which we have paid particular interest, were represented by several species of *Globba*, *Curcuma*, *Amomum*, and *Boesenbergia*. Particularly the *Globba*, which at present is the subject of investigation at our laboratory, showed an interesting variation which could be compared with the one found in the Thung Kang Yang area (cp. LARSEN, 1964a). The composition of the evergreen forest is difficult to describe, but as dominant species we may mention species

of *Castanopsis*, *Lagerstroemia*, some evergreen species of *Dipterocarpus*, e.g. *D. turbinatus* a.o., furthermore *Anisoptera* sp., *Sandoricum* sp., *Sapium baccatum*, *Castanopsis indica*, *Lithocarpus* sp., *Quercus* sp., and a large number of *Euphorbiaceae* forming dense scrubs. The herb flora in the more undisturbed parts of the forest was extremely poor.

Also in this evergreen forest small areas were found with open humid sandstone rocks; in this case, however, no *Sphagnum* species were present, but dense growths of *Aneilema* and *Impatiens* were found. Interesting collections have been made there and in other mountain areas of the genus *Impatiens*, which has an enormously rich variation in Thailand. Unfortunately it does not seem possible at present to determine the many collections made during this and previous trips.

At a slightly lower altitude (600-700 m.) *Livistona cochinchinensis* is a characteristic element of the forest.

Outside the national park certain other areas were visited, particularly the deciduous dipterocarp forest found west of Thung Salaeng Luang along the road towards Nakawn Thai. The vegetation there is composed of *Dipterocarpus tuberculatus*, *Shorea obtusa*, *Dillenia*, and *Phyllanthus emblica* with an undergrowth of *Helicteres*, *Indigofera* and *Randia* species. *Phoenix acaulis* was also found to be common, whereas another character species for the dipterocarp forest, viz. *Cycas siamensis* was not observed. Probably the *Cycas* is restricted to the limestone areas. The herb vegetation was composed of grasses and species of *Scleria* and *Fimbristylis*, often with dominance of the low bamboo *Arundinaria*. Nearly all the grasses were without flowers, but from old inflorescences it could be established that genera like *Eulalia* and *Themeda* are frequent. East of the nature reserve a *Dipterocarpus tuberculatus*-*Pinus merkusii* forest was visited; the altitude of this interesting vegetation is 600-700 m. Besides the two dominant species already mentioned, *Shorea obtusa* and *Dillenia* are common together with an interesting *Quercus* species which may be new, in any case to this part of the country. Furthermore *Lithocarpus* cf. *recurvatus* is not infrequent. The whole vegetation is influenced by man, and in large areas *Imperata cylindrica* and *Pteridium aquilinum* are dominant.

Another locality visited was the Kaeng So Pah. There we found one of the most impressive waterfalls in Thailand, at any rate the senior author has never seen a waterfall like that in the country. The steep rocks around the falls carried a rich vegetation of ferns and mosses, and along the riverbanks an interesting flora of *Zingiberaceae* was found. Genera like *Kaempferia*, *Boesenbergia*, *Curcuma*, *Zingiber*, and *Globba* are all represented by several species. The slopes towards the river are in many cases characterized by good humus soil, while other banks are composed of red laterite. Fortunately, the Kaeng So Pah and its surroundings belong to the nature reserve. The whole area deserves a close study by botanists as well as zoologists.

The above is only a stray contribution to a description of this rich vegetation. Some of the areas are rather much disturbed by man, while others certainly may be described as virgin forests. It was a very good idea of the Royal Forest Department to place a national park there.

From the Thung Salaeng Luang forest station a four days' trip was undertaken to the Phu Mieng mountain with 15 bearers. This trip was favoured by the weather, and the mountain was climbed from the south side. The vegetation at the foothills is well developed and little disturbed *Dipterocarpus-Shorea* forests with plant communities closely related to those already described. At about 800 m. the dry evergreen mountain forest begins, between 800 and 1200 m. most of the southern slopes are deforested, and scattered rice and corn fields from the hill tribes have replaced the formerly rich evergreen forest. Above 1200 m. the vegetation is natural and at the top a large plateau is found with an extremely interesting vegetation comparable with that found on the Phu Krading mountain. According to the accessible maps the Phu Mieng mountain should reach an altitude of about 2100 m.; in our experience this is far too high.

The Phu Mieng mountain is from 1300-1400 m. covered with evergreen forest. Some clearing exists but the scattered Mao houses and fields seem to be abandoned in most cases.

The evergreen forest is dense and dark. Several small water courses intersect this plateau-like area and give a high humidity,

therefore these forests are extraordinarily rich in bryophytes. It will be necessary to undertake many trips up there before a rough idea of the composition of the flora is gained. The ground flora is mainly composed of a large number of ferns, *Phrynium capitatum* along streams and several species of *Staurogyne*. An interesting find was a group of *Newwiedia*, a primitive orchid.

However interesting this evergreen mountain forest may be, it is eclipsed by the highest part of the plateau, on which the forest opens and a great "rock-garden" appears.

This area composed of big sandstone boulders with open sandy grassland and small streams possesses such a beauty as is rarely found in the tropics. Along the margin several species of *Fagaceae* were collected, *Melastoma*, *Osbeckia*, *Michelia*, *Styrax*, *Mussaenda*, and other low shrubs.

The boulders, which may have a surface of several hundred m², are covered with *Sphagnum* (several species), *Selaginella* spp. and *Cladonia* (Fig. 1). *Agapetes saxicola*, *Rhododendron ludwigianum*, *Polygala arillata*, *Ardisia*, and *Hymenopogon* sp. are often dominant together with *Hedychium* sp. (Fig. 2), *Boesenbergia* species (Fig. 3) and an interesting, perhaps new, species of *Caulokaempferia* (cf. LARSEN 1964b). This last species covers the steep humid precipices together with mosses, ferns, *Begonia* and *Impatiens* species. On plain humid sandy soil *Centrolepis cambodiana* is dominant, while other areas are dominated by *Isachne* sp. and several *Fimbristylis* species; mixed with these, *Burmannia coelestis*, *Xyris* (2 sp.), and *Utricularia* sp. are frequent.

There is certainly a close relationship between these plant communities and those found on the Phu Krading plateau. Several of the species are the same, but closely related endemic varieties or species will without doubt be found and a comparison on an ecological basis between the two areas ought to be undertaken. Phu Krading is a far larger area than Phu Mieng, but in beauty the latter is superior.

The Phu Mieng mountain is situated outside the Thung Salaeng Luang National Park; it is highly recommended that the whole area

above 1200 m. be declared a national park, as the vegetation there certainly is unique to Thailand.

The third locality visited was the east side of the Peninsular Thailand between Hua Hin and Chumphon.

A short time ago the Royal Forest Department decided to declare the Sam Roi Yot massif a nature reserve. This is a happy choice, as so far none of the limestone mountains of the peninsula are preserved.

Sam Roi Yot — “the three hundred peaks” — is a rough limestone mountain, which rises from the flat loamy mangroves along the Gulf of Thailand (Figs. 4-5). These mangroves and loamy flats have been described previously by several authors and here we can only add some notes about the composition of the local flora. Along the sea-coast *Ipomoea pes-caprae*, *Vitex trifoliata* and several weedy species compose the first plant community in the tidal area. After this, 1-3 km. loamy soil covered mainly by *Suaeda maritima* and *Trianthema portulacastrum* up to the *Avicennia* shrub further inland. The *Avicennia* shrub is here and there mixed with *Sonneratia*, *Bruguiera* and *Rhizophora* species. Other important components are *Derris trifoliata*, *Flagellaria indica*, and some grasses and *Cyperaceae*.

The limestone mountains are composed of the same hard corroded rocks as found also further north in the Tenasserim range, e.g. along Menam Kwae Noi (cf. LARSEN 1964a). Three very characteristic species, one *Dracaena* (Fig. 6), *Cycas pectinata*, and *Euphorbia antiquorum* are seen all over on steep precipices. The extremely dry rocks have a vegetation of low trees and shrubs. The herb flora is very poor and even in the rainy season few grasses, an *Impatiens*, some geophytes such as *Amorphophallus*, *Kaempferia pulchra*, and *Globba* sp. are observed.

After a few days' stay we moved southwards to a forest experimental station, Huai Yang. This is placed at the sea-shore in a broad belt of *Casuarina equisetifolia*, which is frequently planted all along this coast (Fig. 10).

The sandy beach is characterized by the *Ipomoea pes-caprae* — *Vitex trifoliata* — *Spinifex littoreus* community (Figs. 7-8), behind this

the plantation begins. There the ground vegetation is rather poor in species. But on open areas not yet cultivated the sandy soil is covered with a great number of grasses and *Cyperaceae*, some leguminosae and here and there shrubby vegetation with *Streblus asper*, *Acacia* sp., *Strychnos* sp. a.o. As the sandy soil is gradually changed into lateritic soil, a plant community develops which probably is rather natural. It is a low but dense formation, rich in thorny species of *Rubiaceae* e.g. *Randia* sp., *Zizyphus*, and other *Rhamnaceae*, *Flacourtiaceae*, *Lagerstroemia*, and several *Euphorbiaceae*. Where the soil is more sandy the wood opens and gives place to grass-herb communities. Probably taller trees have been cut, and only trees up to 5-8m. are left. In these scrubs as well as in the *Casuarina* plantations *Gloriosa superba* is so frequent that it may be called characteristic, in any case around Huai Yang.

The shore vegetation was also studied about 75 km. south of Huai Yang, viz. at Ban Saphan Yai. There the sandy shore with the *Ipomaea pes-caprae* community (Fig. 8) alternates with mangroves (Fig. 9). Probably the small area between the promontory and the beach south of that is one of the most undisturbed mangrove areas on the east coast of the peninsula. This in connection with the large number of mangrove species makes it an extremely interesting spot. It has been of great importance to science that the Royal Forest Department has been so foresighted as to establish nature reserves all over the country. But the rapid development of agriculture in the country also makes it necessary now to preserve small areas with characteristic and undisturbed plant communities. Above we have pointed out the flat top of the Phu Mieng mountain. Here on the peninsula we may draw attention to the small, but representative mangrove areas left. In the near future they may be transformed into coconut groves unless the Department saves them.

The mountain range forming the border to Burma was visited in four places between Chumphon and Huai Yang. Most interesting is the Khao Nam Tok—"the waterfall mountain"—about 10 km. west of the forest experimental station. There a luxuriant evergreen forest is found. It was therefore astonishing to visit the lower hills

north of that mountain. These are extremely dry, even in the rainy season practically no ground-flora is found. It was also observed that all the tall and valuable trees were cut and a deforestation is in full development.

The fourth phase of the expedition was a trip to the south-eastern corner of the country. Once more the Chantaburi province was visited (cp. LARSEN, 1964a). This time, however, emphasis was laid on collecting bryophytes on the Khao Sabab mountain and at Khao Gloea north of Makam. Also the Makam plain was studied again.

During the stay in Makam an opportunity was given to visit the famous Koh Chang Island, where the first Danish Botanical Expedition has its headquarters in 1899-1900. To botanists working with the flora of Thailand and Indonesia the name of this island has a special ring. It will not be necessary here to comment on the mangroves and the shore vegetation on which the late Professor JOH. SCHMIDT did his pioneer work.

During the short stay on Koh Chang this year the collections were undertaken in the north-eastern part of the island, particularly the hill situated opposite the fishing hamlet Lem Ngob on the mainland. There, as in the Makam area, particular interest was given to the mosses. The hills, reaching an altitude of 600-700 m., in some places even more, are intersected by deep valleys in which numerous water courses run to the coast. This gives a high humidity, and in most places very rich growths of mosses were observed, even if the number of species is rather limited.

From Koh Chang the expedition returned to Bangkok.

In earlier report on expeditions of the senior author it has repeatedly been emphasized that the natural vegetation of Thailand is now rapidly disappearing. Once more it has been confirmed by the new road running from Nakawn Pathom to the Malayan border. This road has been cut through evergreen forests which have already disappeared. Only in the remotest parts of the country, in the national parks, and certain high mountains accessible only with

difficulty there is still wild life to study. The basic work for future botanical studies, the plant collecting, should not be stopped but continued on a still larger scale during the next years. Many distributional patterns will be difficult to explain if the botanists do not hurry to do their duty. The rice fields and lalang grassland are spreading quickly now.

LITERATURE

- LARSEN, K., 1964a : Report on the Third Thai-Danish Botanical Expedition June-July, 1963.—Nat. Hist. Bull. Siam Soc. **20** : 215-226.
- 1964b : Studies on Zingiberaceae IV. *Caulokaempferia*, a new genus.—Bot. Tidsskr. **60** : 165-179.
- and T. Smitinand, 1966 : The Flora of Thailand Project. Report on the work in 1966.—Nat. Hist. Bull. Siam Soc. **21** : 341.
- SEIDENFADEN, G., 1964 : Report on the Fourth Thai-Danish Botanical Expedition.—Nat. Hist. Bull. Siam Soc. **20** : 227-234.



Fig. 1. Phu Mieng. Sandstone boulder with Sphagnum-Cladonia-Selaginella community.

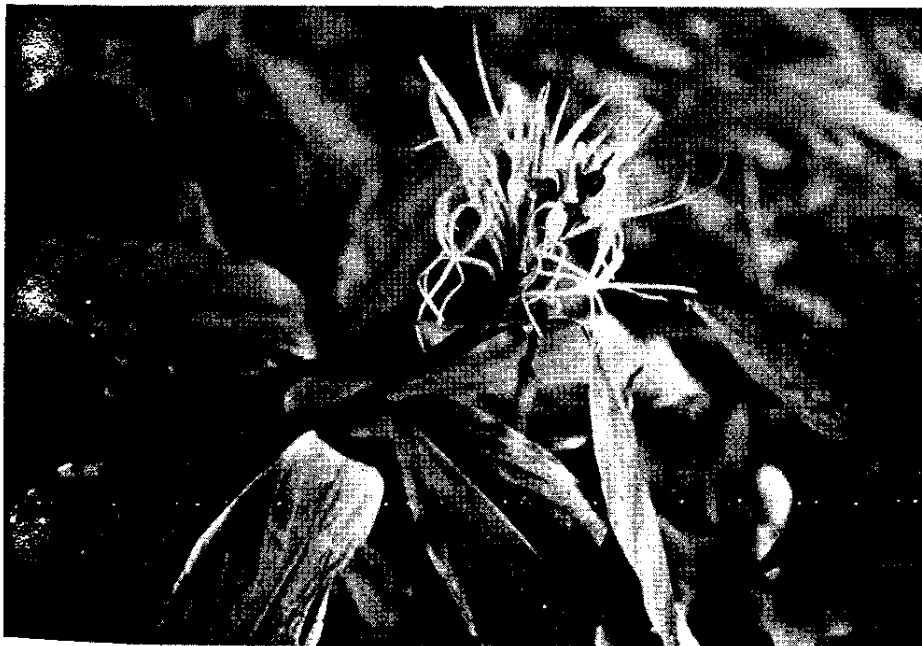


Fig. 2. Phu Mieng. Hedychium sp. common on the sandstone boulder.



Fig. 3. Phu Mieng. *Boesenbergia* sp. common on the sandstone boulders.



Fig. 4. Sam Roi Yot. From the lower limestone outcrops (alt. about 250 m.) towards the tidal plain.



Fig. 5. Sam Roi Yot. Steep limestone mountain.



Fig. 6. Sam Roi Yot. *Dracaena* sp. on bare limestone rock.



Fig. 7. Huai Yang. *Spinifex littoreus* on sandy shore.



Fig. 8. Huai Yang. Sandy shore with *Ipomoea pes-caprae* community.



Fig. 9. Ban Saphan. Mangrove.



Fig. 10. Huai Yang. Casuarina plantation.