

CONTRIBUTIONS TO THE FLORA OF THE ANDAMAN AND NICOBAR ISLANDS

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ABSTRACT

The Andamans and Nicobars are two groups of islands, lying in the Bay of Bengal between the latitudes 6°41' and 13°41' North and longitudes 92°11' and 94°00' East. The Andamans consist of 204 islands, while the Nicobars are made up of 22 islands.

Geology, soil and climate of these islands are discussed. A brief resume of the botanical history of these islands is presented.

The vegetation of the Andamans is classified into 1. Mangrove forests 2. Beach forests 3. Evergreen forests, situated at lower elevations in alluvial land and valleys 4. Deciduous forests 5. Moist evergreen forests at higher elevations 6. Vegetation in cleared lands and open areas. In Nicobars the following types of vegetation are met with 1. Beach forests 2. Evergreen forests 3. Grass lands 4. Marine vegetation. The floristic composition of these vegetations is discussed in detail.

A floristic analysis is presented. The approximate number of Phanerogamic species may amount to 1000 and 700 for the Andamans and Nicobars respectively. The flora has been subjected to the influence of Burma and Malaysia. A number of non-indigenous species have intruded and mixed well with the Andaman flora. A third feature is presence of plants of their own, with a number of endemic species.

INTRODUCTION

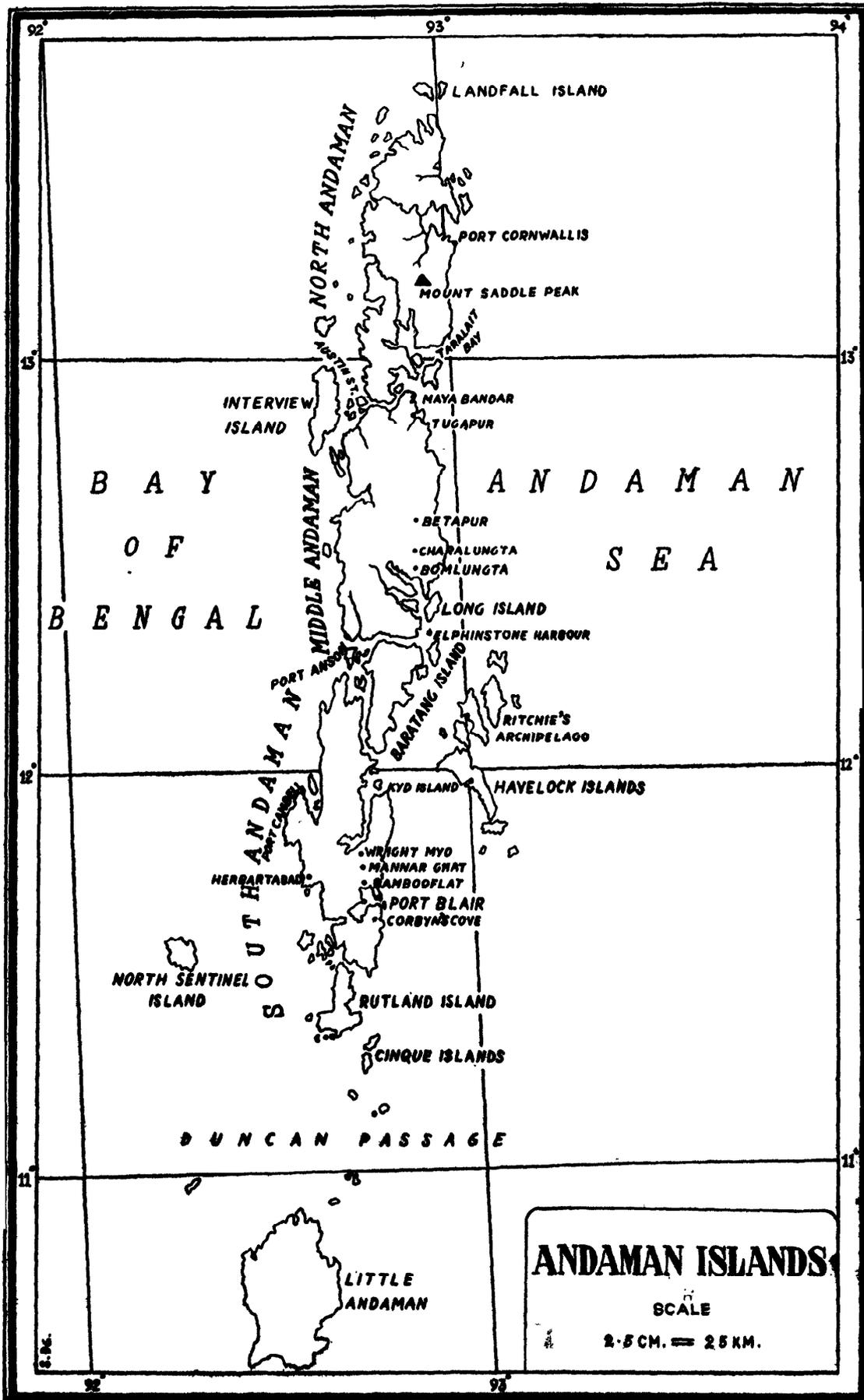
The Andamans and Nicobars are two groups of islands, lying in the Bay of Bengal, separated by a sea-space of 1176 kilometers from the Coromandel coast of India and 515 kilometers from the Tenasserim coast of Burma. The Andaman islands are situated between 13°41' and 10°30' North latitudes and 92°11' and 93°07' East longitudes while those of Nicobars lie between 6°40' and 9°30' North latitudes and 92°30' and 94°10' East longitudes. The sea that separates these 2 groups of islands from the neighbouring coast of Burma and Malayan Peninsula is known as the Andaman sea. The Andamans consist of 204 large and small islands which stretch out more or less in a north-south direction, while the Nicobars are made up of 22 smaller islands, lying in north to south-east direction. The ten degree channel that separates the Andamans from that of Nicobars by a sea-space of 296 kilometers runs in the middle. The land area, occupied by Andamans roughly amounts to 6332 square kilometers while the Nicobars have an area of 1605 square kilometers. The entire length of the former is estimated to be 352.4 kilometers with a maximum width of 51.5 kilometers.

The Andamans form a compact chain of islands. The Nicobars on the other hand lie far separated from one another. The main group of the Andamans can broadly be recognised into the South, Middle and North Andaman respectively which are collectively known as the Great Andaman. Adjoining the main group are the Preparis, Cocos and Landfall Islands on the extreme north, Interview Island on the north-west, the Ritchie's Archipelago, Baratang and Long Islands on mid-east, the Havelock Island on south-east, the Sentinel and Labyrinth Islands on the south-west and

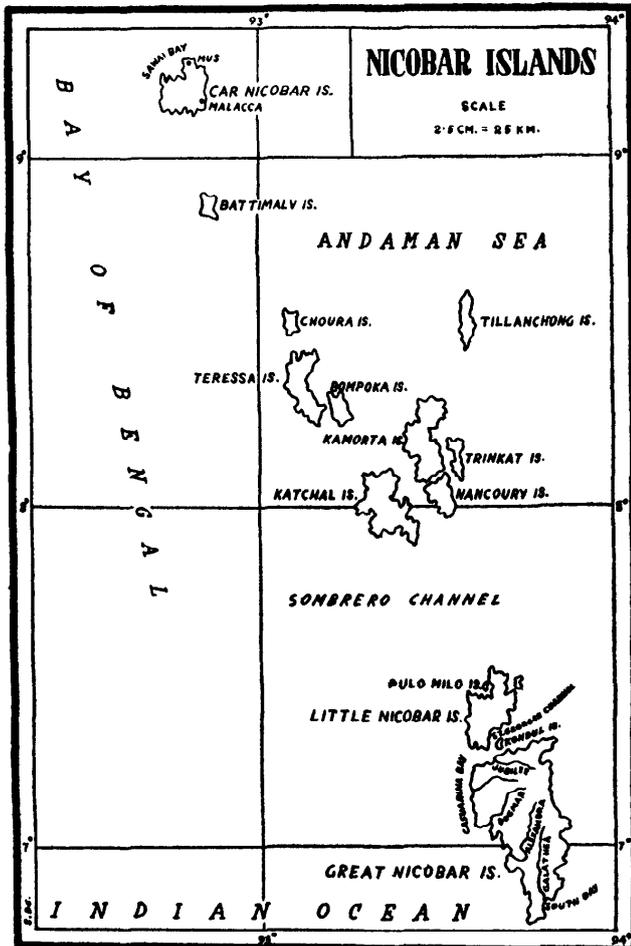
finally the Rutland, Cinque and Little Andaman Islands on the southern extremity. Four straits part these islands more or less in a north-south direction, such as the Austin strait between North and Middle Andaman, the middle strait between the Middle and South Andaman, the Macpherson strait between South Andaman and Rutland Island and finally the Homfray strait. Little Andaman is a small island, 41.8 by 25.7 kilometers, lying south of Great Andaman and is separated from it by the Duncan passage. As regards the Nicobar Islands, Car-Nicobar, and Battimalv Islands constitute the northern group which gradually pass downwards in to the central group, made up of Tillanchong, Choura, Teresa, Bompoka, Katchall, Kamorta, Nancoury and Trinkat Islands respectively. Great Nicobar, Kondul and Little Nicobar Islands lie still further south among the southern group of Nicobars. Great Nicobar and Car Nicobar Islands are fairly larger than the rest. Whereas Car Nicobar, Choura and Trinkat are flat islands, Great Nicobar, Katchall, Kamorta and Nancoury are with hills and ridges.

GEOLOGY

Geologically the Andaman Islands form a part of a lofty range of submarine mountains, 1125.6 kilometers long, running from Cape Negrais in the Arakan Yomah range of Burma, through Sumatra and Java to the Lesser Sunda Islands and the Moluccas and contain much that is geologically characteristic of the Arakan Yomah. In general, the rocks consist of principally noncalcareous, grey, sand-stone and imbedded shales, with occasional nests of poor coal, conglomerates and pale grey lime-stone. The rocks at Ritchie's Archipelago consist of soft lime-stone, formed of coal and shell



sand, soft calcareous sand-stone and white clays with occasional conglomerates. Volcanic fragmentary



rocks, apparently younger occur in the main islands, especially on the east-coast of South Andaman and altered intrusions of serpentine have been noticed in Cinque Islands. There is coral formation along the coast of the islands. There has been of late, a comparative rising in parts of Andaman, especially in the Ritchie's Archipelago and sinking in others, chiefly along the east-coast. Narcondam and Barren Islands are of volcanic origin, the extinct volcano of Narcondam belonging to the Pegu group and the quiescent Barren Island to the Sunda group proper. The older rocks are supposed to belong to early tertiary or late cretaceous but there are no fossils to indicate the correct age of the Andaman Islands.

Our present knowledge on the geology of the Nicobar Islands is mainly due to the observations, made by three scientific visitors, namely Dr. Rink of the 'Galathea' (Danish) expedition in 1846, Dr. von Hochstetter of the 'Novara' (Austrian) expedition in 1858 and Dr. Valentine Ball in 1869. The southern Islands are characterised by predominance of calcareous sand-stones and shales with poor coal, similar to those in Andamans, while clay-stones and associated conglomerates are found in Kamorta, Trinkat and Nancoury Islands. According to Dr. Rink, the

Nicobar Islands form a part of a submarine chain, known for its volcanic activity. The hilly islands consist partly of stratified deposits which occupied the bottom level of the sea before their appearance and partly of plutonic rocks which pierced the former and came to the surface through the old upheaval. The age of the stratified rocks generally indicates a tertiary period. The undulating hilly land of these islands is due to an old alluvium, upheaved by a movement subsequent to that which caused principal upheaval of these islands. In addition to this, there is a distinct new alluvium on the flat lands due to the disintegration of coral reefs which still surround these islands as a circular flat. According to Dr. Hochstetter, the most important formations are eruptive serpentine and marine deposits of a later tertiary period, consisting of sand-stones, slate, clay, marls, plastic clay, and recent corals. The white clay or marls of Kamorta and Nancoury have become famous as being Polycistine marls. The geological division (Kurz, 1876) admirably coincides with the general botanical appearance of the respective islands. While the islands of the southern group are forest clad from bottom to the top, the forests on the northern group are restricted to the plutonic rocks and to the slopes and dells of the older alluvium, with grass lands on hilly plateaux and ridges.

SOIL

The soil in the Andamans is usually soft and deep sandy loam, varying from fine texture of the alluvial flats to the gravel strewn soil of the low hills. The higher hills consist of hard clayey soil with micaceous sand-stone formation and conglomerates below. Upon the nature of the underlying soil depends chiefly the type of forest, found growing in any locality and the different formations of the soil are as follows: 1. Saline low-lying land, the subsoil of which is usually of alluvial formation. This is inundated at regular intervals by the rise and fall of tides and is usually occupied by the mangroves. 2. Alluvial land out of the reach of the sea, lying along the sea-coast and in the valleys and consisting of deep, fertile, clayey or sandy loam. This is favoured by the evergreen forests. 3. Low undulating ground of a somewhat poor and hard rubble or sand-stone formation, where the forests are usually of a leaf-shedding character and where many of the most valuable Andaman timber trees grow. 4. Hills consisting of a yellow-brown and rather stiff, clayey soil of a micaceous sand-stone formation usually covered by tall, evergreen forests. 5. High and steep hills such as Saddle Peak and Mt. Ford, with a hard, red-brown, infertile soil and an underlying rock often of an intrusive serpentine, usually found clothed with dense scrub growth, bamboos and few, small, hard wooded trees.

The soil in Nicobars is mostly of alluvial deposits and plutonic rocks. Polycistine clay covers the

greater part of the islands, especially in Kamorta and Nancoury Islands. According to Dr von Hochstetter, the relationship of geological formation to that of soil and vegetation is as follows :

CLIMATE

The climate in Andamans is just like those of tropical islands of similar latitude. It is warm and

TABLE I

<i>Geological character of the underlying rock</i>	<i>Character of the soil</i>	<i>Nature of vegetation</i>
1. Salt and brackish swamp ; damp marine alluvium	Uncultivable swamp	Mangroves
2. Coral conglomerate to sand ; dry marine alluvium	Fertile, calcareous soil ; carbonate and phosphate of lime	Coconuts
3. As above with dry fresh water alluvium	Fertile, calcareous, sandy soil	Large trees
4. Fresh water swamp and damp alluvium	Cultivable swamp	Pandanus
5. Plastic and magnesian clay, marls partially serpentine	Unfertile clay ; silicates of alumina and magnesia	Grassy open land
6. Sand-stone, slate glabro, dry river alluvium	Very fertile, loose clay and sand, rich in alkalis and lime	Jungle ; true primeval forest

TABLE II

Chart showing mean Temperature (Centigrade) for each month during the years 1955, 1956, 1957

Month	South Andaman			Middle Andaman			North Andaman		
	1955	1956	1957	1955	1956	1957	1955	1956	1957
January	26.8	25.4	25.9	26.3	25.0	25.5	25.7	24.6	24.7
February	26.2	25.5	26.1	25.3	26.4	25.5	25.4	25.3	24.5
March	27.7	27.4	26.5	27.5	27.5	26.1	26.8	27.4	25.3
April	28.7	27.5	28.7	28.7	27.7	28.5	28.6	28.2	27.7
May	27.4	27.2	29.1	27.7	27.3	29.7	27.6	27.4	28.5
June	26.5	26.8	26.9	27.0	27.1	27.9	26.8	27.1	26.7
July	26.6	26.3	26.7	27.1	26.5	27.5	27.0	26.4	26.6
August	26.1	26.2	26.6	26.8	26.5	27.3	26.8	26.8	26.4
September	26.4	26.4	26.7	26.9	26.8	26.9	26.8	26.7	26.2
October	26.3	26.3	26.7	26.6	26.4	26.8	26.4	26.5	26.0
November	26.4	26.7	27.6	26.6	26.9	27.3	26.7	26.4	26.5
December	25.5	26.4	27.6	25.4	25.8	26.6	24.9	25.3	25.5

TABLE III

Chart showing mean monthly total Rainfall (Centimeter) during the years 1955, 1956, 1957

Month	South Andaman			Middle Andaman			North Andaman		
	1955	1956	1957	1955	1956	1957	1955	1956	1957
January	7.13	4.62	1.02	0.99	4.36	0.31	1.75	0.0	0.0
February	2.20	7.06	1.58	0.0	3.60	5.18	0.0	1.98	0.0
March	0.45	3.37	0.0	0.0	0.91	0.0	0.0	0.0	0.0
April	6.75	14.58	0.86	5.76	16.73	0.05	1.44	2.74	1.12
May	70.89	37.41	14.48	82.04	42.67	6.38	65.60	61.01	12.14
June	56.41	37.46	92.51	78.57	32.99	75.48	88.29	34.56	77.84
July	30.53	37.31	39.11	36.27	46.68	25.21	31.92	42.05	24.62
August	49.73	56.23	59.13	21.61	63.67	42.37	33.68	43.12	39.46
September	37.94	29.87	36.90	34.18	33.29	47.48	37.54	31.36	31.25
October	38.20	51.07	34.49	50.34	29.66	30.33	56.89	25.73	27.99
November	31.37	16.35	7.68	39.90	22.37	6.35	33.52	14.35	1.72
December	2.10	7.79	0.69	1.70	1.11	0.94	1.47	0.0	0.0

TABLE IV

Chart showing mean Temperature (Centigrade) for each month during the years 1955, 1956, 1957

Month	South Nicobar			Middle Nicobar			North Nicobar		
	1955	1956	1957	1955	1956	1957	1955	1956	1957
January	27.0	26.1	26.7	27.8	26.9	27.5	27.6	26.3	26.9
February	26.9	26.2	26.7	28.3	26.5	27.5	27.0	25.5	25.8
March	27.5	27.3	27.7	28.6	28.0	28.7	27.7	27.0	26.3
April	27.4	27.3	28.1	28.8	27.7	29.3	27.6	26.6	28.0
May	28.0	26.8	28.6	27.5	27.3	28.4	27.3	27.7	28.0
June	26.7	26.8	27.7	26.7	27.1	27.7	27.3	27.0	27.7
July	26.9	26.5	27.5	26.8	26.6	27.3	26.9	26.9	27.6
August	26.9	27.0	27.3	26.6	26.6	27.1	26.7	26.8	27.3
September	26.9	26.2	26.9	27.2	26.3	27.1	26.6	26.7	27.3
October	26.2	25.7	26.6	26.8	26.5	27.3	26.2	25.7	26.6
November	25.8	26.1	26.9	26.6	27.1	27.7	26.2	26.5	26.8
December	26.7	26.5	26.7	27.3	27.3	27.7	27.0	26.8	27.2

TABLE V

Chart showing mean monthly total Rainfall (Centimeter) during the years 1955, 1956, 1957

Month	South Nicobar			Middle Nicobar			North Nicobar		
	1955	1956	1957	1955	1956	1957	1955	1956	1957
January	16.84	20.49	12.62	8.61	14.45	12.64	8.05	7.21	5.87
February	17.90	18.16	1.73	2.9	23.52	1.47	5.38	15.06	0.76
March	0.28	15.79	4.87	4.19	6.60	1.02	6.24	5.63	0.13
April	19.60	20.11	4.11	7.44	24.53	10.06	11.45	32.18	3.56
May	43.51	67.25	13.95	53.46	38.27	35.44	42.46	36.32	18.53
June	35.73	34.06	35.15	46.86	24.84	32.82	58.01	27.30	52.51
July	21.41	44.50	37.76	13.86	23.16	28.23	28.21	38.43	28.00
August	33.65	43.20	17.38	23.08	42.90	16.52	24.68	27.43	16.39
September	16.40	39.82	30.99	31.47	34.77	25.68	27.53	41.55	21.59
October	37.37	54.35	17.58	38.27	30.17	25.86	48.13	27.76	28.83
November	42.11	23.34	15.56	46.38	25.55	29.17	41.24	11.76	13.22
December	18.28	22.35	27.01	17.55	24.13	35.38	3.58	9.14	26.42

equivable, the mean temperature varying from 21° to 30° C. The rainfall is irregular and amounts to an annual average, 304.8 cm. The islands are subjected to both the south-west and north-east monsoons. Though the rainfall is irregular, the climate is usually dry during north-east monsoon and very wet during south-west monsoon. The hot or dry season comprises the months of January to April while the rest of the year is occupied by the rainy season. The onset of south-west monsoon in May brings with it high winds and heavy downpour of rain, most of which falls during the months of July to September. The north-east monsoon com-

mences in November, accompanied by heavy rain in its earlier part. Cyclones occur at changes of monsoon and are rare.

In Nicobars the climate in general is unhealthy. The islands are exposed to both the monsoons with easterly and north-easterly gales from November to January and south-westerly gales from May to September. Smooth weather prevails from February to April and in October. Rain falls throughout the year, generally in sharp, heavy showers. The annual rainfall varies from 228.6 to 342.9 cm. and the shade temperature from 17.8 to 33.3° C.

BOTANICAL HISTORY

A perusal of the earlier botanical works, dealing with the flora of the Andaman and Nicobar Islands is worth mentioning. The earliest botanical collections from these islands dates back to 1791 when Colonel Kyd visited these islands. This enabled him to introduce a few plants in the Royal Botanic Gardens, Calcutta which were described in Roxburgh's 'Flora Indica'. In 1834 Dr Helfer, a Russian scientist paid a visit to these islands, with a view to ascertain their mineral possibilities. During the course of his work, he made valuable collections of plant specimens. Unfortunately these were mixed up with his Tenasserim collections and were labelled as 'Tenasserim and Andamans'. This has resulted in a great deal of confusion, many of his Tenasserim collections having been ascribed to the Andaman flora. Later Mr. Jelineck of Dr. von Hochstetter's Austrian expedition 'Novara', made a few collections of plant specimens from the Car Nicobar Island. The botanical findings on the flora of Nicobar Islands by Commodore Steen Bille of the 'Galathea' expedition, published in Danish in 1849 were translated to English by N. Wallich (1850). In 1863 Rev. C. Parish from Moulmein collected a few specimens from the Andaman Islands.

In 1866, Sulphiz Kurz, a German Botanist, who was then the Curator at the Royal Botanic Gardens, Calcutta was asked by the Government to proceed to the Andaman Islands and collect material for a flora of these islands. Incidentally, he was also entrusted with the task of investigating and evaluating the forest wealth of these islands. Accordingly, Kurz made extensive collections during his short visit which was confined to the South Andaman. His report on the vegetation of the Andaman Islands, published in 1870 contained 669 Phanerogams and 49 Cryptogams. In addition to this, many of the andamanese plants were also dealt with in his famous 'Forest flora of Burma' (1877). During A. O. Hume's cruise around the Nicobars in 1873, a few collections were made which proved to be new and interesting (Kurz, 1876). Kurz (1875) published a number of new andamanese species in 'Journal of Botany, London'. The first major contribution to the flora of the Nicobar Islands was again by Kurz when he published (1876) his sketch on the vegetation of the Nicobar Islands.

Dr. H. E. Mann's botanical collections from these islands were examined by Dr. King, who was then the Superintendent of the Royal Botanic Gardens, Calcutta and many new plants were named after Mann. Prain in a series of four articles, described the vegetation of Cocos Islands (1891), Narcondam and Barren Islands (1893) and Little Andaman and Car Nicobar Island (1891). The non-indigenous species of the Andaman flora by Prain (1891) is an outstanding contribution to the flora of the Andaman Islands. In 1899 D. Prain and Dr. King

visited the Andaman and the northern group of Nicobar Islands. In the monumental work 'Materials for the flora of the Malayan Peninsula', compiled by Dr. King (1899) and assisted by other botanists, many of the andamanese plants were described which included a number of new species by King, Prain and Gamble.

R. L. Heinig and C. G. Rogers of the Indian Forest service, during their incumbency, made valuable collections and the results were communicated by Gamble (1903) in 'Preliminary list of plants of the Andaman Islands'. In 1914 M. C. Bonnington collected a number of plants from the beach forests of Great Nicobar Island. Later C. E. Parkinson of the Indian Forest Service undertook the major task of compiling a forest flora of the Andaman Islands and his findings were published in 1923. In his account, he described nearly 650 plants, most of them being forest trees, shrubs and important climbers. After Parkinson, a number of forest officers who served in these islands wrote short accounts of the different types of forest vegetation (Chengapa, 1944; Bhargava, 1958). Among the more recent works, mention is to be made of Sahn's (1953, 1958) contribution to the flora of Great Nicobar Island, as well as the mangrove forests of the Andaman and Nicobars. A short account on the fore-shore vegetation of Car Nicobar Island was given by K. S. Srinivasan (1960). Finally the observations and studies, made on the flora of the Andaman and Nicobar Islands by the author during a botanical exploration in 1959 have been published in a series of three articles (K. Thothathri, 1960, 1961).

VEGETATION

The vegetation of the Andamans is discussed first, followed by that of Nicobars. Broadly speaking, the nature and vegetation is directly related to soil as factors such as elevation can hardly influence the distribution of vegetation in islands of such low latitude and altitude. Hence climatically, the islands may be considered to be more or less uniform throughout. The varied habitat, combined with varied configuration has resulted in widely different types of vegetation with great diversity of plant communities. As viewed from the sea, it is observed that from the water edge to the top of the highest hills, they are nearly everywhere densely wooded. The vegetation of the Andamans in general fall under the following distinct types :

1. Mangrove forests which are generally confined to the creeks.
2. Beach forests, found on the coasts and extending a little interior at times.
3. Evergreen forests at lower elevations, found in alluvial land and valleys.
4. Moist deciduous forests.
5. Moist evergreen forests at higher elevations.
6. Vegetation in cleared lands and open areas.

It is roughly estimated that about two-thirds of the area of these islands, excluding the areas under mangrove and beach forests are covered with moist evergreen forests and the remaining one-third by moist deciduous forests.

Mangrove forests (Tidal forests) : The coast line of the islands is irregular and deeply indented, thereby giving rise to a number of tidal creeks. These creeks, which penetrate far inland are subjected to the action of high and low tides when certain amount of land is washed out by the sea. The mangroves develop well in areas which are covered with brackish water during high tides, such as the mud flats along the lower reaches of tidal streams and borders of lagoons and estuaries, more or less protected against heavy wave action and somewhat sheltered from high winds. The soil is saline, with alluvial formation below. These factors offer ideal conditions for the mangroves. The important tidal creeks, which harbour excellent mangroves are the Austin Strait (North Andaman), Porlobjig, Bomlungta and Charalungta (Middle Andaman) and Havelock and Wrafter creeks (South Andaman).

The mangroves are of the gregarious type as they are largely composed of a few species of a particular family, namely *Rhizophoraceae*. The most important and dominant plants are *Rhizophora mucronata*, *R. apiculata* (*R. conjugata* Linn.), *Bruguiera gymnorrhiza*, *B. parviflora* and *Ceriops tagui*, all belonging to *Rhizophoraceae*. Of these species, *R. mucronata* is the most dominant as it occurs in large populations, fringing all along the tidal creeks. It grows to 10-12 meters high, supported by the arching, aerial roots. *B. gymnorrhiza* with a straight stem is the largest mangrove, attaining 10-30 meters easily. All these plants exhibit vivipary, which is characteristic of *Rhizophoraceae*. The seed inside the fruit germinates while the fruit is still attached to the plant and produces a long, pendent, club-shaped radicle which comes out piercing the apex of the fruit. These later fall on the muddy soil when the radicle strikes roots and gives rise to the young one. *Avicennia marina*, with its characteristic pneumatophores is an evergreen littoral tree, frequent in the tidal forests and muddy flats, often forming small patches. Some of the less common plants are *Lumnitzera littorea* with its bright, scarlet flowers, *L. racemosa* and *Excoecaria agallocha*. *Aegiceras corniculatum*, a small tree with fragrant flowers and curved, cylindrical fruits and *Xylocarpus granatum* are the chief associates of *R. mucronata* and *R. apiculata*. Plants like *Heritiera littoralis*, *Brownlowia lanceolata*, *Cerbera manghas*, *Scyphiphora hydrophyllacea* and *Derris trifoliata* occupy the transit zone between the mangroves and the inner littoral forest. The woody, heel-shaped foliodes of *Heritiera littoralis* are often found washed on the sandy beaches. The shrubby growth is constituted by *Acanthus ilicifolius*, *A. ebracteatus* and *A.*

volubilis. The latter two are not common while *A. ilicifolius* is very common, forming large populations, fringing small creeks in tidal streams. *Nipa fruticans* and *Phoenix paludosa* are the only palms, found in the mangrove forest. The former, with its under-ground stem along the tidal creeks and a crown of foliage just above the water makes a picturesque appearance. In places where the brackish water has formed small puddles or streams, populations of *Acrostichum aureum* are noticed, growing in association with *Mariscus pennatus*.

Beach forests (Littoral forests) : The noteworthy feature of this forest is the variety of trees, shrubs and climbers. In the sandy beach, found all along the coast, the fore-ground is marked by *Ipomoea pes-caprae*, a trailer with purple flowers, *Cassytha filiformis*, parasitic on the former and *Phyla nodiflora*. Immediately behind these plants are a number of littoral shrubs. *Scaevola frutescens* makes itself very prominent with its bright green foliage and is one of the dominant species in this zone. Populations of this plant appear as a green hedge, fringing the sea-coast, especially in Little Andaman. *Vigna retusa* trails on the ground and at times climbs up on other plants. Behind the dense growth of *Scaevola frutescens* are other shrubs and shrubby trees like *Xiemenia americana*, *Hibiscus tiliaceus*, *Colubrina asiatica*, *Caesalpinia crista* (Linn.), *Desmodium umbellatum* and *Crinum asiaticum*. *Mucuna gigantea* is a common climber. Populations of *Pandanus tectorius* and *P. andamanensium*, the fragrant screw-pines form impenetrable thickets with their large, pillar like, stilt-roots.

The shrubby growth is succeeded by a layer of trees such as *Thespesia populnea*, *Pongamia pinnata*, *Cynometra ramiflora* var. *mimosoides*, *Guetarda speciosa* and *Ixora brunnescens*. *Hernandia peltata* is a large spreading tree which can be easily recognised by its fruit. The fruit here is a dark coloured, ribbed drupe inside a greenish white, globular receptacle which has a circular opening at the top. Among the other notable trees of this zone are *Barringtonia speciosa*, *Erythrina variegata* Linn. var. *orientalis*, *Cordia subcordata*, *Heritiera littoralis*, *Calophyllum inophyllum*, *Gyrocarpus americanus* and *Terminalia catappa*. Another remarkable plant, found in the littoral forest is *Cycas rumphii* which occurs in large populations, especially in North Andaman. The plant grows to 10 meters high with its main stem forking and giving rise to 3-4 branches. The male strobilus is large and orange coloured while the female strobilus is made of several, loose megasporophylls which bear 3-6 megasporangia. These megasporangia or fruits as they are called, turn yellow when ripe and are cooked and eaten by the andamanese people. The resin, exuded from the tree is applied to malignant ulcers (Kurz, 1870). In Little Andaman and Rutland Islands *Manilkara littoralis*, a hard wooded tree and *Casuarina equisetifolia* are

PLATE I



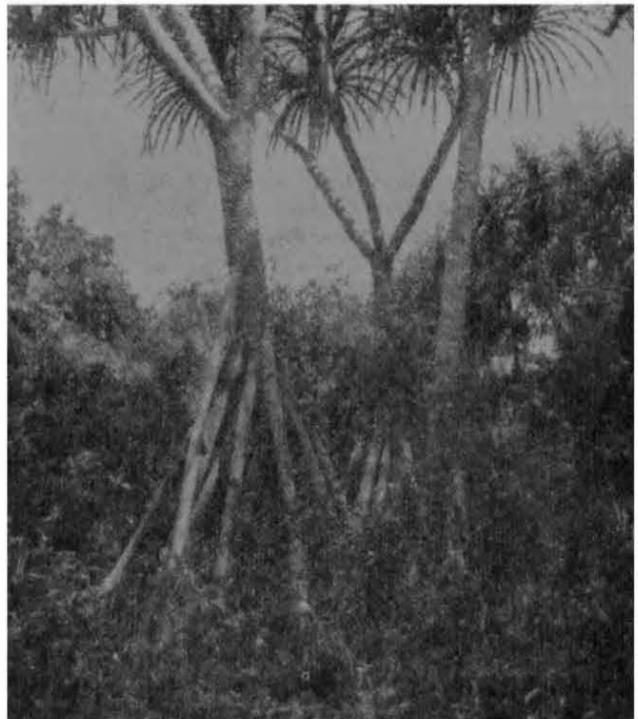
Rhizophora mucronata Lam. in the mangrove forests of Middle Andaman.



Avicennia marina Vierh. with its pneumatophores in South Andaman.



A population of *Scaevola frutescens* Krause in the beach forest of Little Andaman.



Pandanus tectorius Solander with its large stilt roots in Car Nicobar.

PLATE II



Cycas rumphii Miq. with its male cone in North Andaman.



Asplenium nidus Linn. with its large spreading fronds in South Andaman.



Dendrobium pierardi Roxb. an epiphytic orchid in South Andaman.



Illigera appendiculata Bl. a climber with butterfly-shaped fruits in North Andaman.

common in the beach forest, the former forming the well known 'Mohwa' forest.

Evergreen forests: The evergreen forests at lower elevations are situated in alluvial land and in moist valleys. According to Champion, these forests are termed 'Riverain forests'. The soil is made up of mostly deep, fertile clay with micaceous sandstones below. Some of the most important timber yielding species grow in this forest. The vegetation is largely composed of tall trees with a few shrubs, all of them heavily laden with woody climbers. The herbaceous undergrowth in the forest floor is poorly developed. The forests exhibit clear zonations. The top most canopy is formed by tall, gigantic trees such as *Dipterocarpus incanus*, *D. kerrii* etc. These trees reach nearly 40-50 meters in height with a clean, greyish white stem and a crown of foliage at the top. The different species of this genus are popularly known as 'Gurjan' and are of great economic value to the forester. Associated with 'Gurjan' are other trees like *Pterygota alata*, *Terminalia bialata*, *Calophyllum soulattri*, *Albizia stipulata*, *Artocarpus chaplasha*, *Anthocephalus cadamba* etc. Below the top layer is the second layer of trees whose height varies between 20-35 meters. Prominent species of this layer are *Lagerstroemia hypoleuca*, *Dillenia pentagyna*, *Pometia pinnata*, *Myristica irya*, *Litsaea panamonja*, *Duabanga sonneratioides* and *Pisonia excelsa* whose stem and foliage are much liked by the elephants. The lower most story contains those species which can tolerate shade such as *Talauma andamanica*, *Fragraea morindaefolia*, *Mitrephora prainii*, *Garcinia andamanica*, *Macaranga tanarius* and *Pandanus andamanensium*. In a forest of this type, dominated by tall trees only a few shrubs and climbers can thrive. Important shrubby plants are *Saprosma ternatum*, *Maesa andamanica*, *Clerodendrum viscosum*, *Clinogyne grandis*, *Leea indica*, *L. acuminata* and *Areca triandra*. *Dinochloa andamanica* is a climbing bamboo, very common in this forest. Its associates are *Thunbergia laurifolia*, *Illigeria appendiculata*, conspicuous by the butterfly-shaped fruits, *Ipomoea* spp. and *Combretum extensum*. Canes, such as *Calamus longisetus*, *Daemonorops kurzianus*, *D. manii* form a rampant growth, trailing on forest floor as well as climbing over trees. Near stream beds, *Mezoneurum cucullatum* var. *grandis* grows profusely on tall trees and makes itself very conspicuous with its handsome, golden yellow flowers. In some open areas, *Saccharum arundinaceum* and *Phragmites karka* are noticed. The forest floor is practically devoid of any herbaceous growth except a few grasses and marsh plants.

Deciduous forests: Such forests occur in undulating ground in hills, where the soil is comparatively dry as compared to that in evergreen forests. *Pterocarpus dalbergioides*, popularly known as 'Padauk' among the foresters is one of most elegant tree in this forest. It grows to a height of

40-45 meters, supported at the base with huge buttresses. The wood of this tree exhibits different shades of red and brown and some of the finest and most exquisite furniture are made out of this. It is also at times called the 'Andaman red wood' tree. Associated with padauk and growing along with it are a number of timber yielding species, such as *Terminalia procera*, *T. bialata*, *T. manii*, *Pterocymbium tinctorium*, *Canarium euphyllum*, *Parisha insignis*, *Diploknema butyracea* (*Bassia butyracea* Roxb.) *Albizia lebbeck*, *Artocarpus chaplasha*, *Salmalia insignis* and the huge buttressed *Tetrameles nudiflora*. As in evergreen forests the trees here are in different heights. Below these giant trees and occupying the middle stratum between 20-30 meters are *Lannea grandis*, *Sageraea elliptica*, *Sterculia villosa*, *Miliusa tectona*, *Semecarpus kurzii*, *Diospyros pyrrocarpa*, *Zanthoxylum budrunga*, *Garuga pinnata*, *Cratoxylon formosum* and *Pterospermum aceroides*. A few smaller trees are not uncommon and among them, *Streblus asper*, *Licuala spinosa*, *Linociera terniflora*, *Grewia disperma*, *Gelonium bifarium*, *Cleidon javanicum*, *Atlantia monophylla*, *Limonia alata* and *Ochna wallichii* are worth mentioning. The undergrowth in this forest is better developed than in evergreen forests. The shrubby growth is constituted by *Rinorea bengalensis*, *Mulotus acuminatus*, *Actephila excelsa*, *Glycosmis pentaphylla*, *Ixora grandifolia*, *Licuala peltata*, *Bridelia griffithii* and *Calamus viminalis*. A number of climbers and stragglers connect the different layers of trees. *Ventilago madraspatana*, *Sphenodesme unguiculata*, *Thunbergia laurifolia*, *Plecospermum andamanicum*, *Delima sarmentosa*, *Acacia pennata*, *Dinochloa andamanica* and *Calamus andamanicus* are such plants. *C. andamanicus* forms large loops on the ground and then climbs over other trees. *Pothos scandens* is another common climber, found growing adpressed to tree trunks. The herbaceous vegetation of the forest floor are chiefly grasses like *Paspalum conjugatum*, *Echinochloa crusgalli*, *E. colonum*, *Cyrtococcum oxyphyllum*, *Centotheca lappacea* and *Dichanthium annulatum* and a few herbs like *Peperomia pellucida*, *Nelsonia campestris* and *Alysicarpus vaginalis* etc. Occasionally patches of *Pteris quadriaurita*, a spreading fern are also met with.

Moist evergreen forests at hills (High level evergreen forests): The moist evergreen forests of the hills are noted for their richness, luxuriance and variety of plants. Prominent species of the topmost layer of the forest are *Dipterocarpus griffithii*, which has the largest, reddish winged fruits, *D. turbinatus*, *Planchonia andamanica*, very conspicuous by the reddish foliage, *Hopea odorata*, *Planchonella longipetiolatum*, *Endospermum malaccense* and *Prunus martabanica*. The forest floor is covered with the fallen fruits of *Dipterocarpus* species, during March-April. Below this top layer and reaching between 20-30 meters

are *Pometia pinnata*, *Mesua ferrea*, *Podocarpus neriifolia*, *Myristica andamanica*, *Garcinia andamanica*, *G. speciosa*, *Baccurea sapida* etc. Open spaces are covered with shrubby plants like *Anaxagorea luzonensis*, *Actephila excelsa*, *Dracaena helferiana*, *Antidesma diandrum*, *Mallotus repandus* and undershrubs like *Desmodium triquetrum*, *D. heterocarpon*, *Eranthemum palatiferum*, *Daedalacanthus suffruticosus*, *Peristrophe andamanica*, *Lepidagathis incurva* and *Hedyotis paradoxa*. Ferns like *Nephrodium crassifolium* and *Egenolfia appendiculata* grow on boulders. Some of the most beautiful, epiphytic ferns, common in this forest are *Asplenium nidus*, *Drynaria quercifolia*, *Drymoglossum piloselloides* etc. *Asplenium nidus* is met with everywhere, perching upon horizontal branches and tree trunks and with its large, spreading fronds. *Lycopodium phlegmaria* is another epiphytic plant with its slender, hanging branches. The forest floor is moist and is covered with humus and dead twigs. A number of bracket fungi grow well on these dead twigs. *Hypolytrum latifolium*, *Cyrtococcum trigonum* and *Limnophila chinensis* are the few herbaceous plants in the forest floor. The trees in this forest are heavily laden with strong, woody climbers which often reach great heights. *Sarcostigma wallichii*, *Bauhinia* spp., *Smilax aspericaulis*, *Gnetum ula*, *Dinochloa andamanica*, *Calamus palustris* and *Ancistrocladus extensus* are such climbers which make a tangled growth in the forest.

Vegetation in cleared lands and open areas : The vegetation in cleared lands consists for the major part herbaceous plants with a few undershrubs, most of them being nonindigenous to the flora of these islands. Their intrusion into the flora is chiefly due to the agency of man, either intentionally or unintentionally. Virgin forests around Port Blair were cleared at the time of convict settlement (1858-59) which marked the beginning of intrusion of non-indigenous elements. Similarly forests in Betapur, Rungat in Middle Andaman, as well as areas around Mayabandar in North Andaman are now being cleared for the settlement of refugees. Food crops, vegetable yielding plants, fruit and ornamental plants are being cultivated here.

Paddy is mainly grown in cleared lands. Coconuts grow very well near the coasts. *Ananas sativus*, the pine apple is cultivated on slopes of hills. Plants of economic importance such as rubber (*Hevea brasiliensis*), teak (*Tectona grandis*), coffee (*Coffea arabica*) are also tried on an experimental scale in South Andaman. Banana (*Musa sapientum*), papaya (*Carica papaya*), various species of *Citrus*, *Citrullus vulgaris*, the watermelon and *Psidium guajava* are extensively cultivated everywhere. *Anacardium occidentale* has been tried with success in South Andaman. *Citrus grandis* is one of the favourite fruit tree in gardens.

Herbaceous plants such as *Mimosa pudica*, *Geis-*

sapsis cristata, *Fuirena glomerata*, *Jussiaea perennis*, *Blumea amplexans* grow in paddy fields. In places where the soil is marshy and clayey, *Hyptis capitata*, *Hygrophila quadrivalvis*, *Mikania cordata* and *Ammania baccifera* are the favourite plants. Grasses which grow intermingled with these plants are *Paspalum scrobiculatum*, *Ischaemum indicum*, (*I. aristatum* non Linn.), *Eragrostis zeylanica*, *Themeda triandra* and *Heteropogon contortus*. *Vitex trifolia* is one of the common shrubs in road sides and waste lands. Associated with it are *Jatropha curcas*, *Triumfetta bartramia* and *Urena lobata*. *Eupatorium odoratum* and *Lantana camara* var. *aculeata* are the two, most common plants which are spreading rapidly in cleared lands. The common trees, *Ficus rumphii* and *Samanea saman*, found in and around Port Blair harbour a number of epiphytic ferns and orchids. *Drynaria quercifolia* and *Pyrrosia adnascens* are the two, important, epiphytic ferns. Associated with them are orchids like *Dendrobium secundum* with its handsome, pink spike, the fragrant flowered *D. pierardi* and *Cymbidium aloifolium*. *Dischidia bengalensis* and *D. mummularia* hang freely from the branches of trees. *Halophila ovalis* and *Enhalus aceroides* are the only marine, angiospermic weeds, occurring in shallow waters in the tidal zone. Herbaceous undergrowth in the jungles around Port Blair consists of *Coldenia procumbens*, *Elephantopus scaber* and *Rungia pectinata*. In sandy soils near the coast, *Zornia diphylla*, *Oldenlandia corymbosa*, *Ischaemum muticum*, *Lawnaea sarmentosa* and *Crotalaria retusa* are the favourite herbs.

Nicobars : The nature of vegetation and the floristic composition of the North, Central and South Nicobar Islands differ from one another. In Car Nicobar, there is a well defined beach forest, followed by inland vegetation consisting of shrubs, shrubby trees and grass lands. The island, being more or less flat and the soil consisting of sandy alluvium with rocks beneath, evergreen forests are remarkably absent. Tidal mangrove forests, a common feature of the central and southern group do not find a place here. Major portion of the land area is occupied by coconut and arecanut palms which grow more or less self-sown. There is a well defined mangrove forest in the central and southern group, followed by the littoral forest at the coast and evergreen forest at the interior. In general the vegetation of the Nicobar Islands can be classified into the following:

1. Beach vegetation
2. Tidal mangrove forests
3. Inland evergreen forests
4. Patches of deciduous forest
5. Grass land and open vegetation
6. Marine vegetation

Beach vegetation : The beach forests or the dune forests (Dr. Junghuhn) are restricted to the beaches of fine calcareous sand which stretch along

the shores. The formation of such beaches is more pronounced in Car Nicobar. Creepers that mark the beginning of beach vegetation are *Ipomoea pes-caprae*, *Vigna retusa*, *Ischaemum muticum*, *Phyla nodiflora* and herbs like *Acalypha indica* etc. *Scaevola frutescens* is the immediate successor to these plants, growing in large populations and appearing as a green hedge, fringing the coast. Associated with it are *Desmodium umbellatum*, *Clerodendrum viscosum* and *Premna serratifolia* etc. *Tournefortia argentea* is a large shrub with silvery pubescent leaves and is very common in Katchall, Kamorta and Great Nicobar Islands. *Pandanus leram* (Nicobar bread fruit tree), *P. tectorius* and rarely *P. furcatus* grow luxuriantly in this forest. *Ixora brunnescens* and *Glochidion calocarpum* flourish well here. The shrubby layer is followed by a few trees like *Barringtonia asiatica*, *Terminalia catappa*, *Calophyllum inophyllum*, *Hernandia peltata*, *Pongamia pinnata*, *Heritiera littoralis*, *Ficus rumphii*, *Odina wodier* and *Syzygium samarangense*. *Cycas rumphii*, *Cerbera manghas* and *C. odollam* grow well under the shade of these trees. *Casuarina equisetifolia* is found in abundance in the Casuarina bay in Great Nicobar. Climbers are not uncommon and are represented by *Cyclea peltata*, *Wedelia scandens*, *Operculina turpethum*, *Entada scandens*, *Colubrina asiatica* and *Derris trifoliata*. The ground cover consists of grasses like *Cenotheca lappacea*, *Oplismenus compositus*, *Chrysopogon aciculatus*, growing intermingled with *Ophiorrhiza mungos*, *Aerva lanata*, *Kyllinga monocephalata* and *Cyperus umbellatus*. The tree trunks are clothed with *Dischidia bengalensis*, *D. mummularia* and *Pothos scandens*. *Aerides emercii*, a beautiful, pink flowered orchid, *Dendrobium anceps* and *Luisia teretifolia* are the common orchids met with. A noteworthy feature is the presence of *Barringtonia asiatica* throughout the coast of Car Nicobar, heavily laden with the epiphytic fern *Asplenium nidus*. Another interesting feature is the association of epiphytic ferns, found growing together on branches of small trees in Car Nicobar. *Vittaria elongata* is one such fern with its characteristically long, slender, ribbon like fronds hanging downwards. Associated with it are *Asplenium nidus*, *Pyrrosia longifolia* and *Phymatodes scolopendria*. These ferns, with their creeping rizome and roots form a thick mattress on the branches of trees.

Mangrove forests: Such forests are found in West Katchall bay, the harbours of Kamorta and Nancoury Islands, Little Nicobar and in Ganges harbour, mouths of Galathea, Dogmar and Alexandra rivers in Great Nicobar. The tidal creeks which harbour these forests do not penetrate deep inland as in Andamans. The dominant species are again *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Excoecaria agallocha*, *Carallia brachiata*, *Sonneratia acida*, *Timonius jambosella* and *Nipa fruticans*.

Tropical evergreen forests: The true, evergreen forests are noticed in Great Nicobar, Kamorta and Katchall Islands. In Great Nicobar the forests are extensive and completely cover the hill ranges and even flat areas. According to Kurz (1876), in Katchall and Kamorta Islands, the evergreen forests, found on plutonic rocks are dense with tall timber trees and those growing on calcareous sand-stone are sparsely wooded. Our knowledge about the true evergreen forests of Great Nicobar is scanty. According to Sahni (1953), the most common and dominant tree species in Great Nicobar are *Calophyllum soulattri*, *Sideroxylon longipetiolatum*, *Endospermum malaccense*, *Garcinia xanthochymus*, *Adenanthera pavonia*, *Albizzia lebeck*, *Pisonia excelsa* and *Mangifera sylvatica*. In moist valleys and along rivers, *Anthocephalus cadamba*, *Pometia pinnata*, *Elaeocarpus tuberculatus*, *Litsaea panamonja* and *Terminalia procera* are met with. *Alsophila albo-setacea*, a tree fern with feathery foliage is a prominent and common species in this forest. *Dinochloa andamanica* is the most extensive climber.

Patches of deciduous forest (Sahni, 1953) with *Terminalia procera* and *T. bialata* have been reported at low elevations in Great Nicobar. These trees have the characteristic large buttresses and grow in association with *Pterocymbium tinctorium* and *Albizzia* spp.

Kurz's (1876) vivid account of the evergreen forests of Kamorta and Katchall Islands is the most extensive and exhaustive one. The forests clothe the hilly ranges and abruptly terminate just below the top of the hilly plateaux. The lofty tree species are chiefly *Artocarpus peduncularis*, *Radermachera lobii*, *Pterocymbium tinctorium*, *Symplocos leiostachya*, *Bentinckia nicobarica*, *Ternstroemia macrocarpa*, *Ficus retusa*, *Dillenia pentagyna*, *Calophyllum soulattri*, *Albizzia chinensis* and *Alstonia macrophylla*. Growing well under the cover of these trees, are smaller tree species like *Maesa ramentacea*, *Barringtonia racemosa*, *Macaranga gigantea*, *Antidesma persimile*, *Aporosa microstachya*, *Dracaena griffithii*, *Syzygium claviflorum*, *Apodytes andamanica*, *Ochna andamanica*, *Leea indica* and *Erioglossum rubiginosum*. *Alsophila albosetacea* is again the most common tree fern here. All these trees are heavily laden with woody climbers, which due to their tangled growth make the forests impenetrable. Important climbers are *Derris thyrsoiflora*, *Cissus pedata*, *C. repens*, *Dinochloa andamanica*, *Dioscorea glabra*, *Smilax polyacantha*, *Erycibe paniculata*, *Anodendron paniculatum*, *Gnetum latifolium* var. *macropodum*, *Calamus andamanicus* etc. *Pothos scandens* and *Gymnopetalum heterophyllum* often creep up on tree trunks. The forest floor is covered with herbaceous plants such as *Blumea myrioccephala*, *Lasianthus laevicaulis*, *Homalonema aromatica*, *Adenostemma viscosum* and *Marrubium dichotoma*. A few grasses and sedges like *Hypolytrum*

latifolium, *Scleria sumatrensis*, *Kyllinga monocephala*, *Oplismenus compositus*, *Cenotheca lappacea* and *Thysanolaena maxima* grow along with the herbaceous plants. Ferns are plentiful and prominent species are *Nephrodium molle*, *Asplenium nidus* and *Vittaria elongata*, the latter two being epiphytic on trees. These epiphytic ferns are frequently associated with orchids namely, *Pholidota imbricata*, *Oberonia* spp. *Saccolabium obliquum* and *Trichoglottis quadricornuta*. *Lycopodium phlegmaria* grows profusely on the branches of trees. In some of the fresh water marshy swamps, formed by the accumulation of rainwater *Helminthostachys zeylanica* is a favourite plant, growing together with *Polygonum flaccidum*.

A certain amount of dense forest growth is noticeable on raised coral reefs behind the dunes in Kamorta and Katchall Islands. These forests differ from the true character of evergreen forests. A few tall trees only could be found here. *Garcinia speciosa*, *Alstonia kurzii*, *Ficus indica*, *F. retusa* and *Artocarpus pomiformis* represent the tree growth. Smaller trees are *Orophaea katschallica*, *Aglaia andamanica*, *A. argentea*, *Cupania jackiana*, *Apodytes andamanica*, *Olax imbricata*, *Ixora weberae-folia* and *Mallotus acuminatus*, all of them giving a dense appearance to the forest. Shrubby growth is little developed with plants like *Psychotria nicobarica*, *P. tylophora*, *P. andamanica* and *Ixora kurziana*. Associated with these shrubs are few climbers like *Dinochloa andamanica*, *Antitaxis calocarpa* etc. Herbaceous growth is poorly developed, except a few grasses.

Grass lands: These are peculiar to Nicobars only and are situated on hilly plateaux of Kamorta, Katchall and Nancoury Islands as well as in open areas of Car Nicobar. They are for the major part, made up of grasses together with plants like *Lycopodium cernuum*, *Dicranopteris linearis* etc. Trees are rare and a few shrubs are not uncommon. The grass lands are also termed 'Grass heaths' (Dr Die drichsen), *Imperata cylindrica*, locally known as 'lalang' occurs in large populations together with *Saccharum spontaneum*. Associated with them are *Eragrostis zeylanica*, *Heteropogon controtus*, *Chloris barbata*, *Chrysopogon aciculatus*, *Eragrostis unioides* and *Scleria cochinchinensis*. Often *Dicranopteris linearis* and *Lycopodium cernuum* grow amidst these grasses, forming pure patches. *Urena lobata*, *Triumfetta rhomboidea*, *Desmodium heterocarpon*, *D. heterophyllum* and *Uraria lagopodioides* are the few undershrubs and herbs. *Lygodium flexuosum* is a spreading fern among the grasses. The shrubbery is little developed and the common ones are *Erycibe paniculata*, *Helicteres angustifolia* var. *obtusata* and *Melastoma malabathricum* etc.

Marine vegetation: The sandy beach is fringed around with coral reefs and so a number of marine algae grow luxuriantly in tidal zones. Members of the Chlorophyceae, commonly occurring in these

waters are species of *Enteromorpha*, *Ulva*, *Codium*, *Halimeda*, *Caulerpa*, *Dictyosphaeria*, *Acetabularia* and *Borgesenia*. Phaeophyceae is represented by species of *Padina*, *Turbinaria* and *Sargassum*. Species of *Liagora*, *Jania*, *Ceramium* and *Gracilaria* constitute the Rhodophyceae. Most of them remain attached to the coral reefs and at times washed ashore during high tides.

FLORISTIC ANALYSIS

Kurz (1870), in his report on the vegetation of Andaman Islands estimated a total 520 indigenous, phanerogamic species, distributed among 300 genera. Of these 520 species, 209 are trees, 116 and 82 are shrubs and climbers respectively and the remaining 113 are annual and perennial herbs. He recognised about 76 species as introduced and non-indigenous to the flora. The most richly represented genera according to him are *Ficus* with 13 species, *Vitis* with 8 species, *Sterculia* with 6 species, *Cordyline*, *Cyperus* with 5 species each and *Memecylon*, *Ipomoea*, *Myristica*, *Calamus*, *Asplenium* and *Pteris*, each with 4 species respectively. A total of 32 species, new to science from the Andaman Islands were described by him. Kurz's estimate on the cryptogamic flora roughly amounts to 345 species, composed largely of Fungi (200 species), the remaining being Lichens (40 species), marine and fresh water Algae (37 species), Musci and Hepaticae (37), Lycopodia (1) and Filices (30).

Parkinson's (1923) forest flora of the Andaman Islands deals with nearly 650 higher plants which include 540 indigenous and 110 introduced ones. The 540 native ones are composed of 310 trees, 90 shrubs and 140 climbers. Herbaceous elements are not taken into consideration as his flora was primarily concerned with forest species. The 540 species have been accommodated in 85 families of which *Leguminosae* is richly represented with the largest number of species. *Euphorbiaceae*, *Rubiaceae*, *Moraceae*, *Annonaceae*, *Palmae* and *Meliaceae* are the other dominant families in the flora.

The author, during his recent visit (1959) collected a total of 281 species of Angiosperms, Gymnosperms, Ferns and their allies, distributed over 230 genera among 85 families. *Euphorbiaceae* is the most widely distributed family with over 35 species, followed by *Gramineae*, *Rubiaceae*, *Leguminosae* and *Compositae*. *Ficus* with 7 species, *Oldenlandia*, *Ipomoea*, *Desmodium*, each with 4 species and *Ischaemum*, *Cryptococum*, *Eragrostis*, *Euphorbia*, *Mallotus*, *Claoxylon*, *Merremia*, *Dendrobium* and *Pteris*, all with 3 species each are the dominant, generic constituents in the flora. The author concentrated more on the herbaceous elements, as very little has been known about them. Nearly one-third of the total collections are herbaceous plants (103 out of 281), the remaining being shrubs (88), climbers (37) and trees (53). Thus the

herbaceous plants form 36.65% of the total collections and are largely composed of grasses.

TABLE VI

Habit	Kurz (1870)	Parkinson (1923)	Thothathri (1959)
Trees	209	310	53
Shrubs	116	90	88
Climbers	82	140	37
Herbs	183	—	103
Total	590	540	281

Kurz was of the opinion that the really indigenous phanerogamic flora of the Andamans may range between 1500—1800 species, which estimate appears to be high. Prain (1891) suggested that the Andaman flora may in all probability have in it nearly 1000 indigenous phanerogams. Apart from this, a number of species, introduced by human agency, either intentionally or unintentionally thrive so well that many have become naturalised. Kurz noticed about 76 such species while Parkinson observed 110 non-indigenous species. The author came across 64 species of this category. Prain (1891) has given a remarkable account on the history, origin and present status of the non-indigenous elements in the Andaman flora. According to him, such species have come in to the flora primarily due to human agency either direct or indirect as there is very little chance for the exotics to cross over the sea. Introduction by means of wind and birds is applicable only to continents and adjacent islands but not to isolated groups of islands. Many such intentionally introduced ones are ornamental, garden and avenue plants like *Michelia champaca*, *Cananga odorata*, *Hibiscus rosa-sinensis*, *Leucaena glauca*, *Quisqualis indica*, *Allamanda cathartica*, *Delonix regia*, *Ixora coccinea*, *Bougainvillea glabra* and *Mirabilis jalapa*. Economically important plants such as cereals, fruit and vegetable yielding species and such other food crops have been of late introduced in to these islands. Important among such plants are *Annona squamosa*, *Brassica oleracea*, *Citrus medica*, *C. decumana*, *Mangifera indica*, different species *Phaseolus*, *Psidium guajava*, *Punica granatum*, *Musa sapientum*, *Citrullus vulgaris*, *Carica papaya*, *Cucumis melo*, *Anacardium occidentale*, *Ricinus communis*, *Ananas sativus*, *Areca catechu*, *Zea mays* and *Oryza sativa* etc. Recently rubber (*Hevea brasiliensis*), coffee (*Coffea arabica*) and teak (*Tectona grandis*) are being tried on experimental level to improve the economy of the islands.

Majority of the non-indigenous elements in the flora are common, Indian, road-side and paddy field weeds whose seeds would readily be found, mixed with the imported grains or attached to the belongings of convict immigrants or of the police sepoy of the settlement. This mode of introduction explains

not only the occurrence of weeds of dry ground but also of the majority of marshy plants like *Hygrophila*, *Jussiaea*, *Ludwigia* etc. Other aquatic plants like *Monochoria*, *Ceratopteris*, *Ipomoea reptans* owe their introduction indirectly to human agency since, but for the settlements, the ditches and pools would not exist. Wind and birds have very little role in this introduction except for species of *Selaginella*, *Cheilanthes* and *Ceratopteris*.

Nicobars: The flora of Nicobars is comparatively less known than that of Andamans. Many of the Islands like Teresa, Choura, Tillanchong have not been botanically studied. Even the interior forests of Great Nicobar have not been fully explored. It is therefore very difficult to assess the total number indigenous species that make up the flora of the Nicobar Islands.

Kurz (1876) enumerated nearly 624 species from the Nicobars, while Sahni (1953) reported 189 species from Great Nicobar Island. The author (1959) observed nearly 60 species in Car Nicobar Island. Taking all these facts into consideration, a probable estimate of the floristic elements may roughly amount to 700. Future intensive explorations in these islands will reveal a number of new and interesting taxa. Out of this 700 species, many are present in the Andamans. The role of non-indigenous elements in the flora of Nicobars is almost nil.

A comparative study of the vegetation of the North, Middle and South Andaman show that a profuse growth of epiphytic vegetation, consisting mostly of orchids and ferns are well represented in South Andaman. The forests at Long Island and Bharatpur in Middle Andaman are mostly of moist deciduous type while those at Tugapur and Austin in North Andaman are of the wet evergreen type. Woody climbers are better represented in North Andaman.

A striking feature in the flora of Nicobars is the complete absence of evergreen forests in the Northern group of islands namely, Car Nicobar, Battimalv, Choura and Teresa, while such forests constitute a major vegetation in the Central and Southern Nicobars. Coconuts, arecanuts and Pandanus are found in abundance in Car Nicobar while mangroves are absent.

A comparison of the flora of the Andamans with that of Nicobars brings out a number of interesting points. The tree fern namely, *Alsophila albo-setacea*, which is a characteristic species of tropical evergreen forests is totally absent in Andamans but is found in abundance in Nicobars. The principal, Andaman timber trees, 'Gurjan' (*Dipterocarpus* spp.) and 'Padauk' (*Pterocarpus dalbergioides*), found in the evergreen and deciduous forests do not find a place in Nicobars. Mangrove forests are better developed in Andamans rather than Nicobars. The occurrence of Grass heaths or Grass lands is peculiar to the Nicobars only. Typical deciduous forests which are

hardly present in the Nicobars, form the major type of vegetation in Andamans. Endemism seems to be more pronounced in the Nicobar Islands. The Andaman flora has in it a number of Malayo-burmese elements while that of Nicobars is more of Malaysian in character.

Flora in relation to neighbouring countries: An analysis of the various constituents of the flora of Andaman and Nicobar Islands indicate that they have been subjected to the influence of neighbouring countries, namely Burma and Malaysia. The thick, mangrove forests of similar character described earlier, are found in Malayan Peninsula and Philippines. The dense, moist, evergreen forests of these islands are counterparts of those in Malaysia. Among the interesting species occurring in these islands, whose main distribution is that of Burma, mention must be made of plants like *Anaxagorea luzonensis*, *Dipterocarpus incanus*, *Anoistrocladus extensus*, *Cupania adenophylla*, *Geissapsis cristata*, *Olex imbricata*, *Jasminum subglandulosum*, *Linociera terniflora*, *Tournefortia ovata*, *Lepidagathis incurva*, *Sphenodesme unguiculata*, and *Aporosa villosula*. A number of plants, common in Malaysia have been observed to occur frequently in the Andaman and Nicobar Islands. Plants that are distinctly malaysian in character are *Pyrrosia longifolia*, *Scolopia spinosa*, *Mucuna gigantea*, *Mezoneurum cucullatum*, *Pithecellobium angulatum*, *Combretum extensum*, *Barringtonia racemosa*, *Syzygium samarangense*, *Casearia glomerata*, *Timonius jambosella*, *Diospyros discolor*, *Planchonella obovata*, *Erycibe paniculata*, *Merremia vitifolia*, *Thunbergia laurifolia*, *Clerodendrum viscosum*, *Callicarpa longifolia*, *Pisonia excelsa*, *Helicia serrata*, *Alchornea javensis*, *Bridelia griffithii*, *Claoxylon indicum*, *Gelonium bifarium*, *Ficus gibbosa*, *F. rumphii*, *Pipturus velutinus*, *Clinogyne grandis* and *Licuala spinosa*.

Endemic flora: A third interesting feature in the flora of the Andaman and Nicobars is the presence of plants of their own, many of which are endemic to these islands. Species that have been reported so far from the Andamans only are *Dillenia andamanica*, *Orophaea hexandra*, *Trivalvaria dubia*, *Polyalthia parkinsonii*, *Miliusa tectona*, *Xanthophyllum andamanicum*, *Dipterocarpus kerrii*, *Hopea andamanica*, *Aspidopterys andamanica*, *Ailanthus kurzii*, *Canarium manii*, *Dysoxylum andamanicum*, *Amoora manii*, *Chailletia andamanica*, *Hippocratea andamanica*, *Gouania andamanica*, *Mangifera andamanica*, *Mezoneurum andamanicum*, *Planchonia andamanica*, *Memecylon andamanicum*, *Lagerstroemia hypoleuca*, *Lasianthus andamanicus*, *Maesa andamanica*, *Ardisia andamanica*, *Linociera parkinsonii*, *Peristrophe andamanica*, *Strobilanthes glandulosus*, *Myristica andamanica*, *Cryptocarya andamanica*, *Linostoma andamanica*, *Drypetes andamanica*, *Mallofus andamanicus*, *Blachia andamanica*, *Glochidion andamanicum* and *Macaranga andamanica*. The above species do not occur even in Nicobars.

Plants that are known only from the Nicobars are *Orophaea katschallica*, *Crateva macrocarpa*, *Garcinia jelinekii*, *Atalantia macrophylla*, *Hippocratea nicobarica*, *Otanthera nicobarensis*, *Modecca nicobarica*, *Mussaenda jelinekii*, *Aporosa glabrifolia*, *Bentenckia nicobarica* and *Trichoglottis quadricornuta*. The flora of Great Nicobar is still in its original form, unmixed and untouched by man owing to its isolated position. It may therefore be assumed that its flora may still contain a number of new and endemic species. New records (Thothathri, 1961) of 13 plants have been added to the flora of these islands. Among the more important ones are *Scolopia spinosa*, *Casearia tomentosa*, *Lepidagathis incurva*, *Hyptis capitata*, *Helicia serrata* and *Pyrrosia longifolia*. Most of the new records are either of malayan or burmese in origin.

Deficiencies and peculiarities: Families like *Ranunculaceae*, *Zygophyllaceae*, *Valerianaceae*, *Dipsacaceae*, *Vacciniaceae*, *Ericaceae*, *Cupuliferae* and *Platanaceae* are notably deficient in the flora. Inland, aquatic vegetation is poorly represented in the flora which may be attributed to the scarcity of water. The extreme scarcity of annuals and weeds beyond Port Blair is undoubtedly a most remarkable feature in the andamanese flora.

ACKNOWLEDGEMENTS

The author wishes to convey his grateful thanks to Dr. H. Santapau, Director, Botanical Survey of India for going through the paper and offering valuable suggestions. He is thankful to Dr. S. K. Mukerjee, Keeper, Central National Herbarium and Dr. K. Subramanyam, Deputy Director, Botanical Survey of India for their keen interest and kind encouragement in the preparation of this paper.

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