

Flora of India
Series 3

FLORA OF PALGHAT DISTRICT
Including Silent Valley National Park,
KERALA

E. VAJRAVELU



BOTANICAL SURVEY OF INDIA

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FOREWORD

The Botanical Survey of India is publishing the Flora of India under four series of which the 'District Floras' is one among them. The Flora of Palghat District including Silent Valley National Park, Kerala is one such contribution to the Flora of India.

Silent Valley harbours one of the last remnants of rich tropical forest flora which is vast disappearing. The genetic resources it supports cover a vast spectrum of useful species, rice, pepper, banana, jackfruit, cardamom, cinnamomum, aroids, etc. The inventory of the species of this forest hold, are important for the *in situ* conservation of species.

The Malabar Coast was, since ancient times, the sole centre of the spices trade with Arabs and Europeans. van Rheede, the Dutch Governor of the Malabar during early part of 17th century, compiled the monumental *Hortus malabaricus* and published in 12 volumes containing 794 plates (1678-1703). In spite of several subsequent botanical expeditions to this area, information with regard to the plant resources of this state is still not fully available to the scientific world. For judicious exploitation of plant resources, an inventory of plants occurring in any given area is absolutely necessary. Hence this district flora including the Silent Valley R.F. was undertaken and worked out in detail. The flora of this district comprises 1400 species of flowering plants which constitute about 25% of the species reported in the *Flora of the Presidency of Madras*, for the then Presidency of Madras comprising present states of Andhra Pradesh, Tamil Nadu, Karnataka and Malabar of Kerala State.

The significant findings of this flora include two new genera, six new species, five new records, many endemics and rare plants, many relatives of cultivated plants - being the germ plasm resources and a variety of economically and medicinally important plants.

I hope the present flora would be very useful to the students and teachers of botany, conservationists, ecologists, agricultural scientists, foresters and others concerned with the utilization of plant resources. The flora would also be found useful by environmental biologists and taxonomists revising the Flora of India.

Botanical Survey of India,
Calcutta, 700001,
19 Jan. 1990.

M.P. NAYAR
Director

CONTENTS

	<i>Page No.</i>
INTRODUCTION	1
AREA OF STUDY	2
TOPOGRAPHY AND SOIL	5
PREVIOUS WORK	9
MATERIALS AND METHODS	10
GENERAL ASPECTS OF THE VEGETATION	11
HILL TRIBES	23
ENVIRONMENTAL FACTORS	23
PLANTS OF ECONOMIC IMPORTANCE	24
STATISTICAL DATA	26
PLAN OF PRESENTATION	27
CONCLUSIONS	28
SYSTEMATIC TREATMENT	33
Artificial key to the families	33
Enumeration	43
SELECTED REFERENCES	593
INDEX TO BOTANICAL NAMES	603

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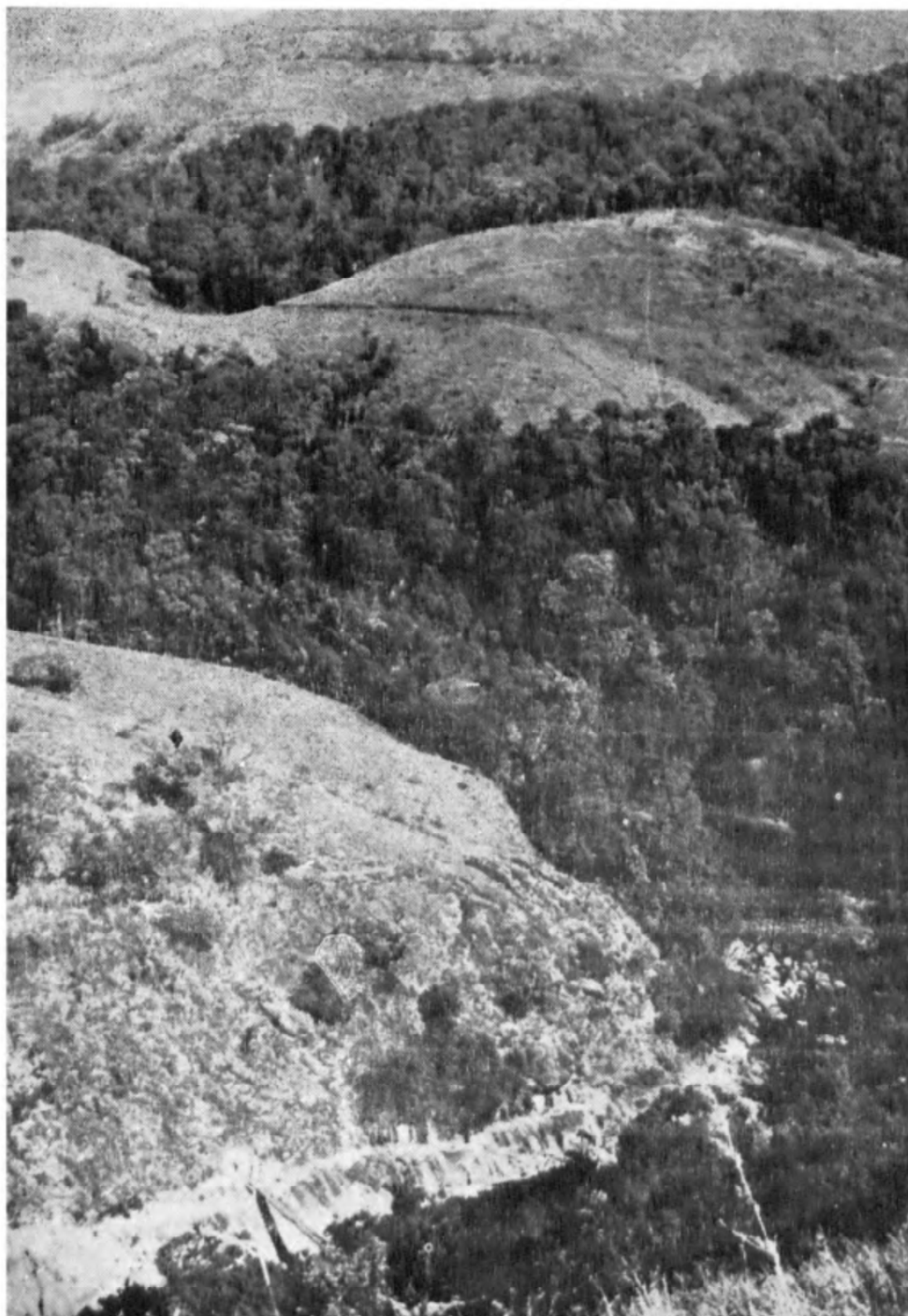


Plate 1 : Dense forests along the banks of river Kunthipuzha. [*Page 11*]



Plate 2 : A strangler (*Ficus* sp.) in Silent Valley. [*Page 12*]



Plate 3 : A view of the Silent Valley R.F. from Kerala State Electricity Board Rest Shed, [Page 15]



Plate 4 : Grasslands and sparse vegetation on way to Valiyaparathode forest. [*Page 19*]



Plate 5 : Terrace cultivation near Sirunelli estate in Nemmara Division. [Page 23]

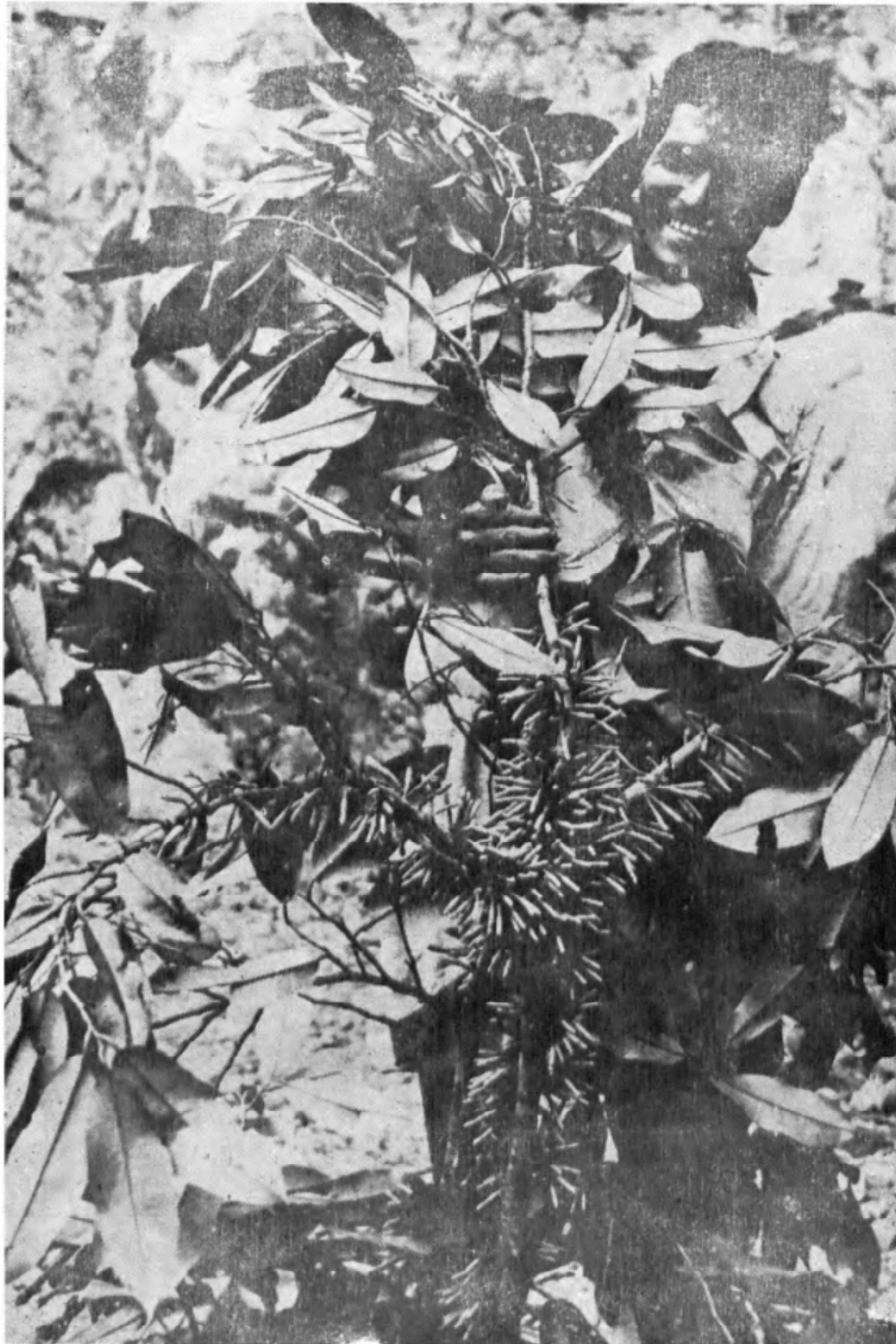


Plate 6 : *Cullenia exarillata* Robyns (BOMBACACEAE) - a common
cauliflorous evergreen tree. [Page 87]

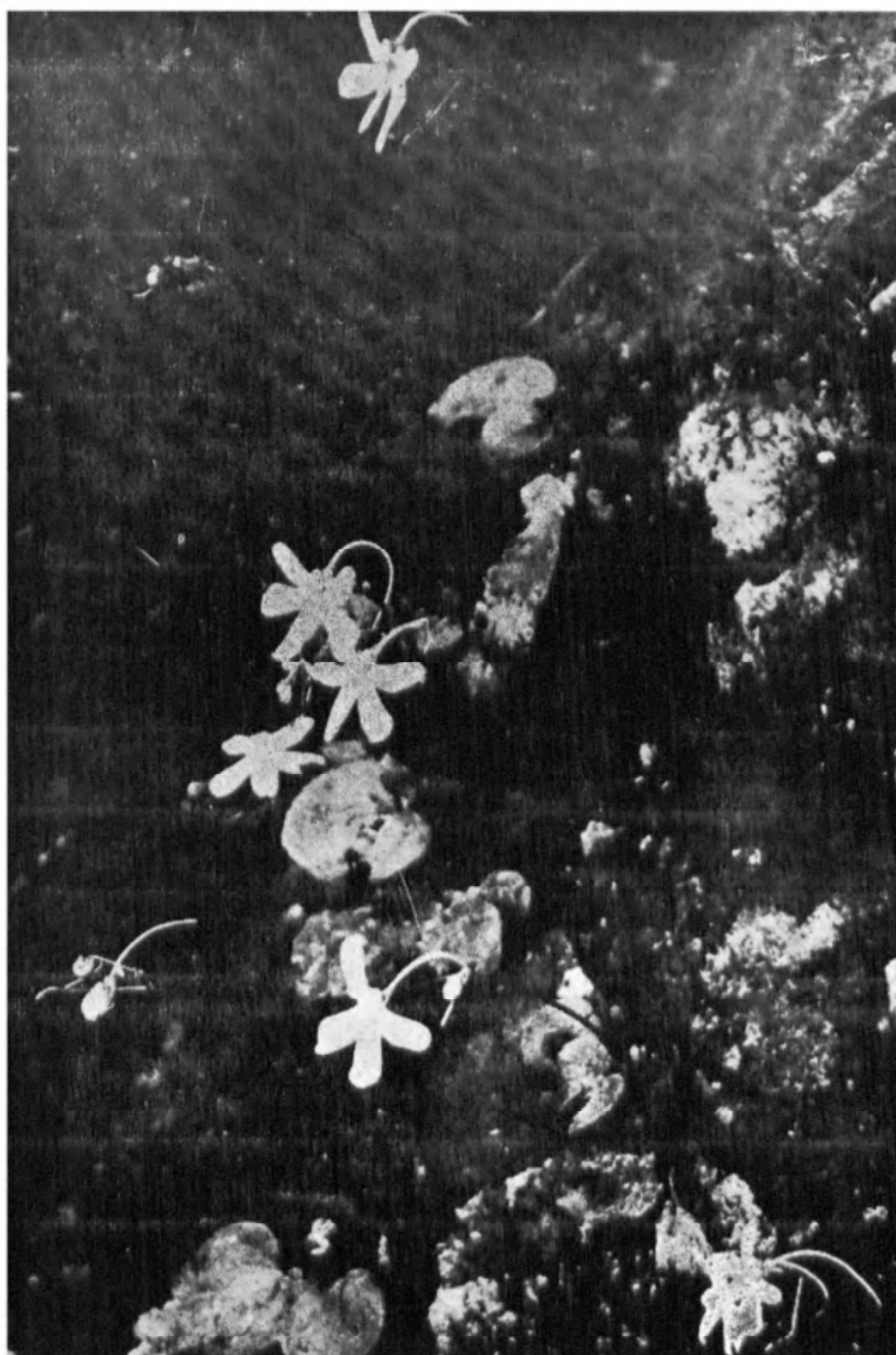


Plate 7 : *Impatiens scapiflora* Heyne ex Roxb. (BALSAMINACEAE) - a showy, acaulescent herb on wet rocky slopes. [Page 101]



Plate 8 : *Tetrameles nudiflora* R. Br. (DATISCACEAE) - a lofty deciduous tree in fruits. [Page 217]

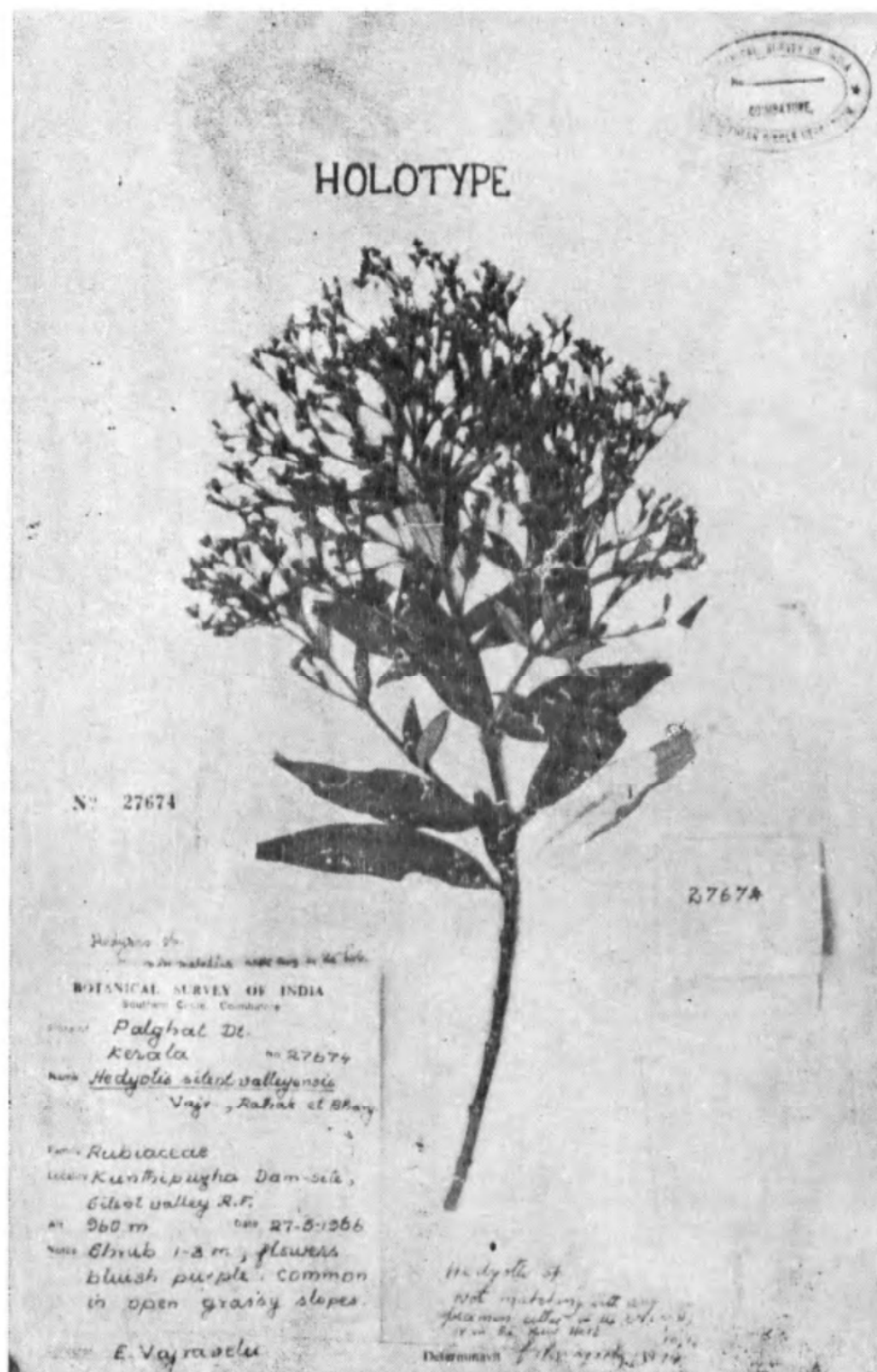


Plate 9 : *Hedyotis silent-valleyensis* Vajr. et al. (RUBIACEAE) - Holotype
of a new species discovered from the Silent Valley R.F. [Page 232]



Plate 10a : **Kanjaram palghatense** Ramam. (ACANTHACEAE) - a new genus and new species from the district. [Page 354]

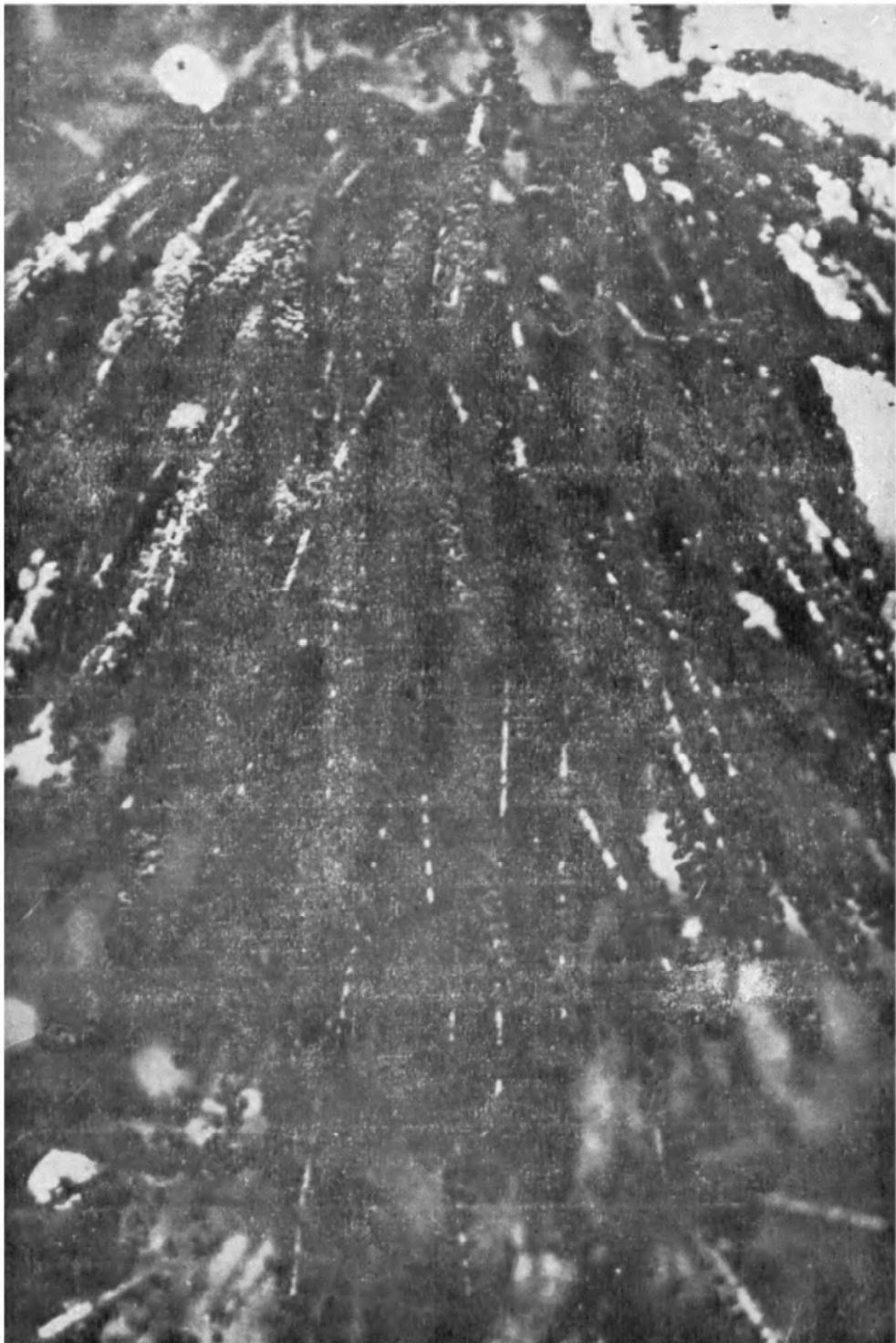


Plate 11 : Cauliflorous *Baccaurea courtallensis* Muell. - Arg.
(EUPHORBIACEAE). [Page 421]



Plate 12 : *Acanthephippium bicolor* Lindl. (ORCHIDACEAE) - a showy orchid introduced in the BSI Garden from the Silent Valley R.F. [Page 466]

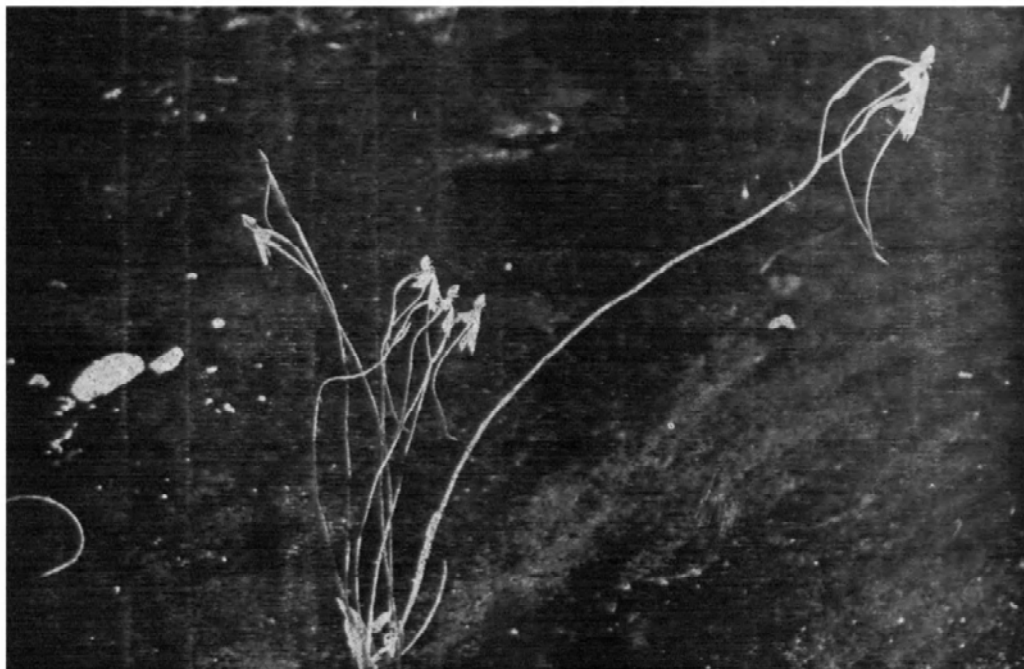


Plate 13 : *Habenaria longicorniculata* Grah. (ORCHIDACEAE) - a pretty orchid with white flowers. [Page482]

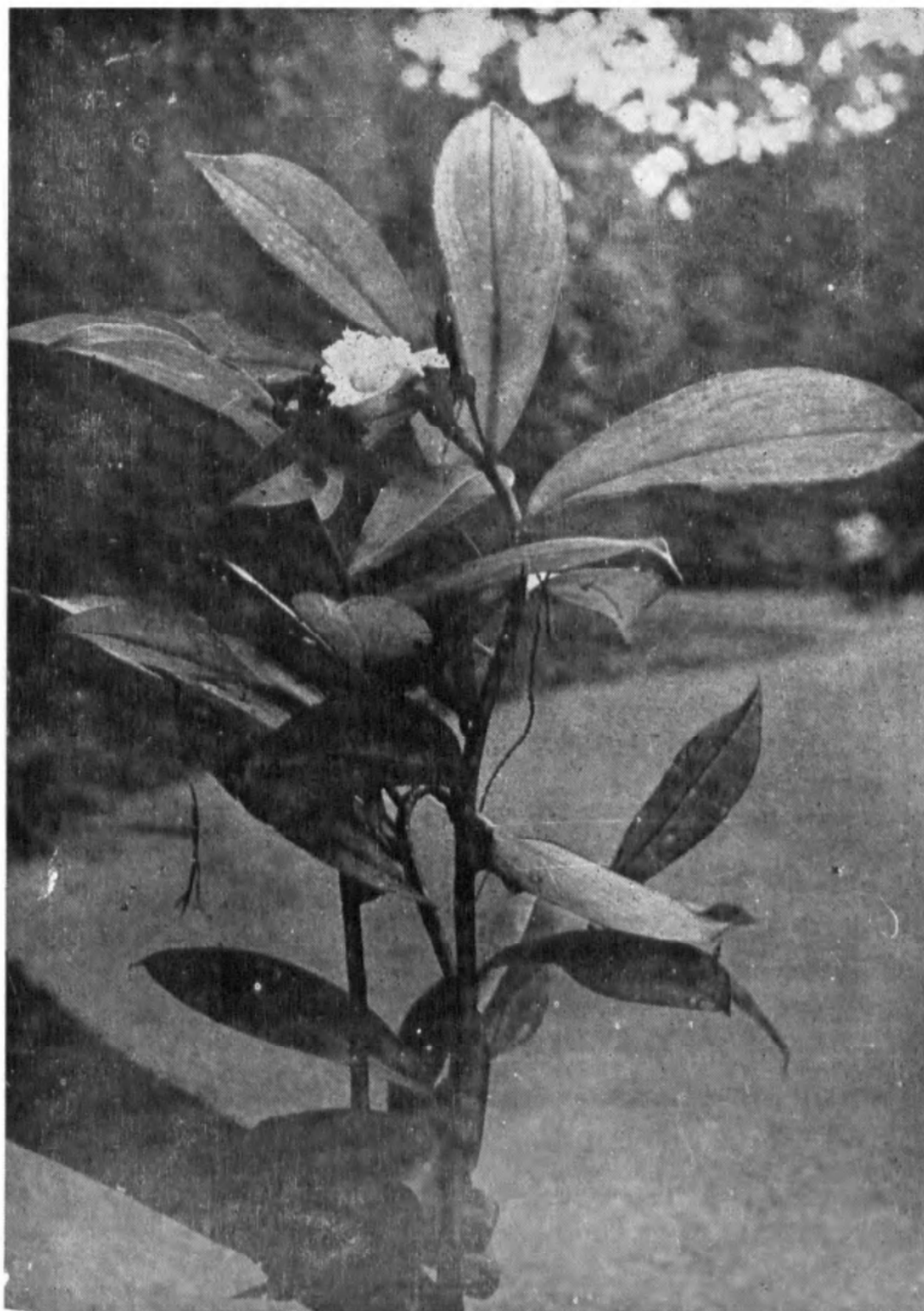


Plate 14 : *Costus speciosus* Sm. (ZINGIBERACEAE) - an important medicinal plant. [Page 498]

INTRODUCTION

It has been pointed out in no uncertain terms that the tropical forests, by far the richest in species diversity and mostly confined to the developing countries are being destroyed at a rapid rate without adequate compensation in terms of conservation of representative vegetation types and genetic resources (Tomlinson & Raven, 1977). A similar opinion encompassing other related aspects as well that the diversity is being reduced before we have made a basic inventory let alone conducted modern biosystematic and population biology studies in the area and that even to understand the origin and dynamics of the temperate flora it is essential to have adequate knowledge of the tropical flora from which the temperate flora was derived has been expressed by Prance (1977). Raven (1977) has very justifiably emphasised the fact that destruction of habitats leads to the extinction of species even before they are discovered and described and that such a disappearing plant species can take with it 10-30 dependent species such as insects, higher animals and even other plant species. The importance of the forests in the Indian context has been stressed in the following passage by Sagreiya (1978) : 'The forests of our country are natural asset of immense value. Directly forests meet the domestic needs of polewood, fuel, bamboos and a variety of other products, including providing grazing to livestock, which are the indispensable requirements of rural population... Forests also yield a number of products of commercial and industrial value, such as structural timbers, charcoal, raw materials for making paper, newsprint, panel products, beedi leaves, resins, gums, tanstuff and a host of other products of economic importance including medicinal plants. They also provide employment to a large population engaged in their protection, tending, harvesting, regenerating and management.. Indirectly, forests preserve the physical features, arrest soil run-off, mitigate floods and make the streams flow perennially and thus help agriculture. Forests also make the climate equable, reduce air pollution by absorbing the poisonous carbon dioxide and releasing the life giving oxygen. Wildlife is an integral part of the forests and is of recreational and scientific value'.

Population explosion and its consequent pressure on tropical forests resulting in over-exploitation has been identified as the prime factor leading to their destruction. It has been now realised that the long-held opinion that the tropical forests are an infinite source of natural resources is a fallacy and that unless exploited judiciously it would exacerbate the already worse situation resulting in very serious consequences. For such a

judicious exploitation of plant resources an inventory of plants occurring in any given area is absolutely necessary ; more so in a developing country like India with a telling effect of the impact of population explosion. Hence the objective of the present investigation is to present a comprehensive and consolidated account of the vegetation and flora of Palghat district, Kerala, a floristically very rich province which would enable the authorities concerned to assess the plant wealth of the area as and when required.

AREA OF STUDY

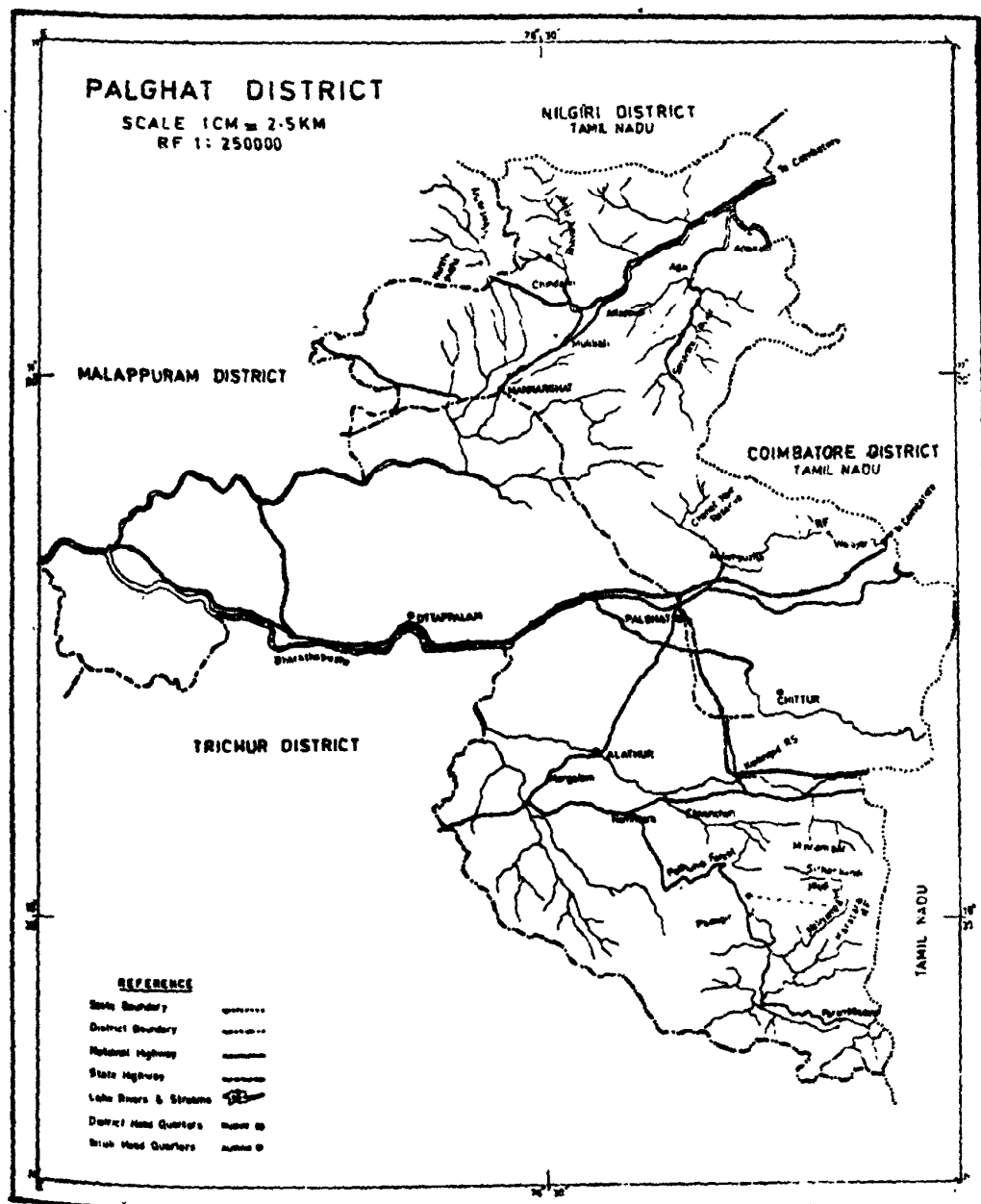
Origin of the name Palghat

There is no unanimous opinion as to the origin of the name 'Palghat'. It is said that the name is derived from the traditional Tamil classification of the land on the basis of soil formations and physical features. Accordingly places which "were for the most part desert regions hardly fit for raising food crops and were in many places barren and rocky were called 'PALA' or 'PALAI'. The presumption of a section of scholars therefore is that the name Palghat originated from the physiographic term 'Pala' or 'Palai' that denotes the barren and rocky regions combined with the word 'Kaadu' or forest, meaning thereby the land covered by rocky regions and forests. But considering the fertile plains of the district and other physical features of the place it seems that Palghat can never come under the traditional classification of the 'Pala' region.

A more convincing argument is that the whole of Palghat and its suburbs were once covered by thick forests of 'Pala' trees (*Alstonia scholaris*) hence the word 'Pala' plus 'Kaadu' came to be known as Palakkaadu, later anglicised as Palghat. In the East India Company's correspondence the place is referred to as 'Palghatcherry'. This name is also found on certain old herbarium sheets with plants collected from this district and housed in the Madras Herbarium (MH).

Location and boundaries

Palghat district is located between north latitude 10° 20' and 11° 15' and east longitude 76° 02' and 76° 55'. It is bounded by Malappuram and Nilgiri (State of Tamil Nadu) districts on the north, Coimbatore district (Tamil Nadu) on the east, Trichur district on the south and Malappuram and Trichur districts on the west. The district has no coast-line.



Area and population

The area of this district is 4,400 sq km and ranks fourth in the state in area. The total population according to 1971 census is 16,85,342. The total male members is 8,19,571 whereas the number of females is 8,65,771.

History of the district

When the states of the Indian Union were formed on linguistic basis under the State Reorganization Act (Central Act 37 of 1956), the erstwhile Malabar district was separated from the then State of Madras (now Tamil Nadu) and integrated with the Travancore - Cochin state to form the new linguistic, Malayalam speaking State of Kerala. But due to the unwieldy nature of the district, the Malabar district was trifurcated into the revenue districts of Cannanore, Kozhikode and Palghat. At present Palghat district consists of 5 taluks viz., Alathur, Chittur, Mannarghat, Ottapalam and Palghat.

Natural divisions

On the basis of physical features, the district can be divided into two major natural divisions, viz. midland and highland. The midland region includes the low laterite downs of the district having an attitude of up to 80 m above mean sea level. The highland region lies above 80 m. The unique feature of the highland is the great Palghat Gap which is a complete opening with a width of about 32.2 km.

The forests of Palghat district are under the administrative control of the Palghat and Nemmara forest divisions. The respective headquarters of these two divisions are located at Olavakkot (Palghat) and Nemmara, controlled by Divisional Forest Officers. In addition there are Assistant Conservators of Forests for Plantations, Wildlife, Forest Utilization etc. with a band of other forest officers. The area of the Palghat division is about 372 sq km.

The Nemmara Forest Division was constituted on 1st July 1958, by amalgamating the Nelliampathy Range of Trichur Forest Division, Parambikulam Range of Chalakkudi Forest Division and Sungam Range of Coimbatore South Division of Tamil Nadu State which was transferred to Kerala State as a result of the reorganization of states. The forests of the Parambikulam Range and higher reaches of the Nelliampathy Range represent the evergreen forest types. The country reserves of Nelliampathy are of purely deciduous type with a high proportion of good quality of teak in its composition.

The major portion of the forests in this district form the catchment area of three major reservoirs (i) Parambikulam—Aliyar Project of Tamil Nadu State (ii) Mangalam and (iii) Pothundy Dams of Kerala State.

The Malampuzha Dam in the Palghat Division attracts many tourists since there is a well-organized park with a wide variety of ornamental plants and illumination facilities on holidays. The aquarium of rare, beautiful and colourful fishes is an added attraction.

TOPOGRAPHY AND SOIL

The topography varies with hills and valleys ; rivers, rivulets and streams making the vegetation very rich. Plains are restricted to the southwestern portion only. The main ghats are situated at the northern extremity and extend up to the Nilgiris. The highest peak 'Anginda', about 2600 m is at the northeast corner of the Silent Valley. An extensive region of dense forest covering nearly 39,000 hectares clothe the northern slopes and this region is recognized for the sake of forest administration as constituting four blocks namely Attapadi (12,000 ha.) and Silent Valley (8,950 ha.) on the south and Kundha (10,000 ha.) and New Amarambalam (8,000 ha.) on the north. The Attapadi and Kundha blocks constitute the eastern half and cover a larger area (22,000 ha.) than the other two. The Silent Valley reserve lies on a plateau to the north of Mannarghat, the outer slopes of the hill forming a tableland. The ghats stretch southwestwards but an irregular north-south ridge through the middle divides the Silent Valley area into two, the ridge itself slopes southwards. The two rivers draining the area are Kunthipuzha on the west and Bhavani on the east of the ridge, both flowing down north to south. Kunthipuzha continues its southwardly course for several km after emerging from the forest areas till it meets the west-flowing Thuthupuzha river - a tributary of Bharathapuzha.

The Dhoni R.F., Sappal hill forest and the Eliwal block constitute 'The Chenat Nair Reserve' which is situated on the southern extremity ending at the Palghat Gap. The Walayar Reserve is situated on the northern side of the eastern end of the Palghat Gap, and at the foot of the Bolampatty hills. The Walayar river which forms almost the state boundary of Tamil Nadu and Kerala across the national highway, runs through the forests. The Nelliampathy Ghat in the Nemmara Division also extends up to Parambikulam bordering the Apamalai Hills in Tamil Nadu. The general configuration is undulating with hills, deep ravines and valleys, well-clothed with vegetation excepting the large grassy areas around Muthikulam and certain slopes of the Silent Valley along river Kunthipuzha.

The rock formation is of gneissic origin. Soil in the plains is sandy loam and clayeyhumus, whereas on the slopes of hillocks the substratum is gravelly and coarse. In certain places barren rocks are found. Rocky substratum is predominant along slopes of Pothundy and Malampuzha hills.

Rainfall

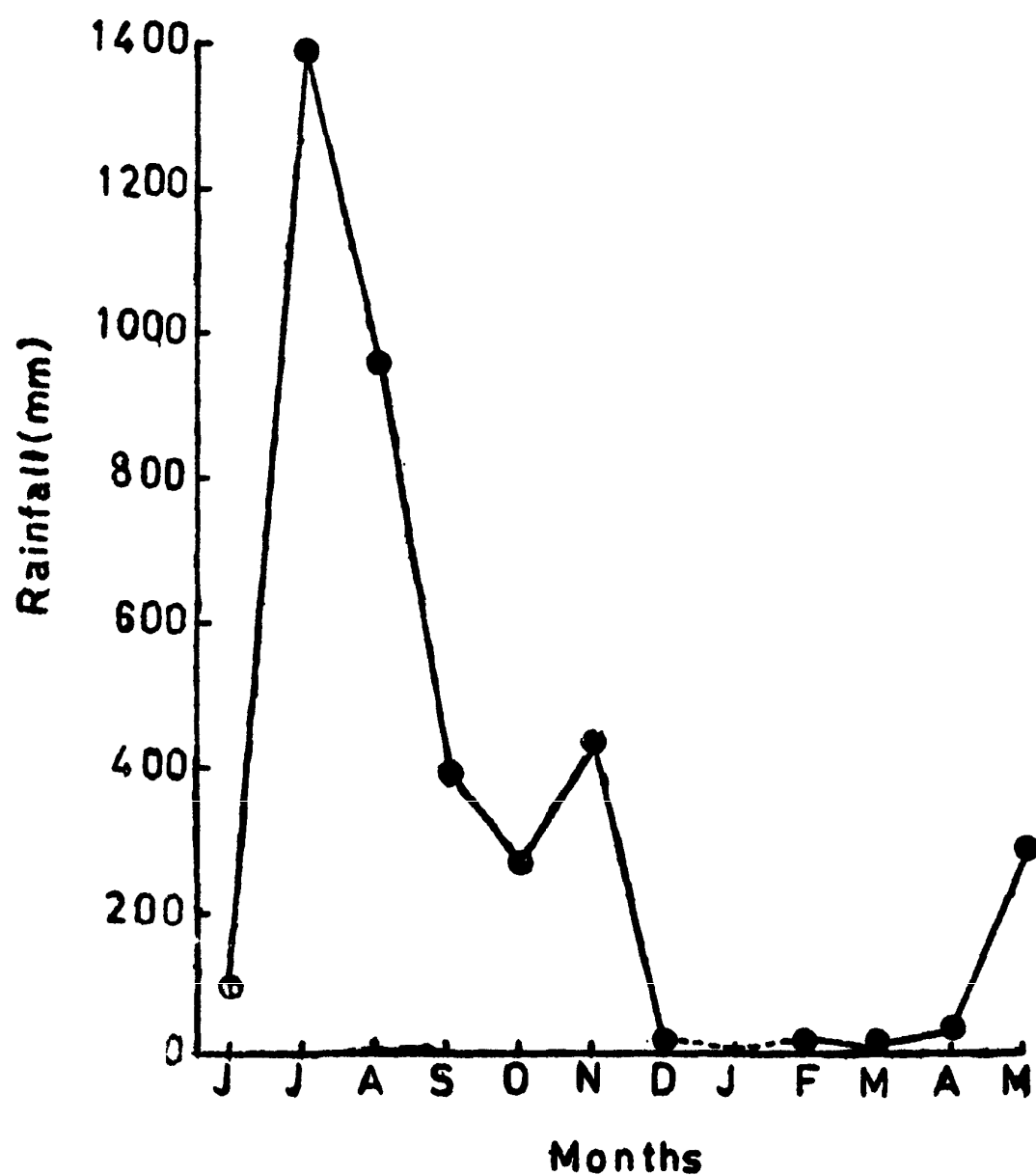
Monthly Rainfall Data of the Silent Valley-Attappadi Forest Regions During the Years 1958-1963 and 1977-1979.

Month	1958-59	1959-60	1960-61	1961-62	1962-63	1977-78	1978-79
	in mm						
June	1290	1890	450	1380	430	911	1036
July	1320	2150	1590	1760	2540	1452	1337
August	1110	870	850	1430	1150	584	1337
September	270	550	720	470	750	393	289
October	450	250	230	290	530	388	136
November	710	70	140	—	70	408	449
December	30	—	—	150	90	—	20
January	—	—	—	20	—	—	—
February	—	—	30	30	—	—	22
March	—	80	—	10	40	—	12
April	110	230	80	50	40	41	31
May	760	270	620	350	50	157	424
Total	6050	6360	4710	5940	5690	4334	5093

Average annual rainfall : 5454 mm.

The graph provided is based on the average rainfall of 1977-1979.

The average annual rainfall decreases from the west towards the east and varies from 4800 mm to 1100 mm. The southwest monsoon generally sets in during the last week of May. The rainfall during the southwest monsoon (June to September) constitutes about 70% of the annual rainfall. During October there is again an increase in the rainfall. The rainfall in April-May and October is mostly thundershowers. On an average there are 111 rainy days (days with a rainfall of 2.5-10 mm or more) in a year. The number varies from 122 at Mannarghat to 93 days at Chittur.



Rainfall of Palghat District based on the average of three years, 1977-79. (Data obtained from Kerala State Electricity Board).

Temperature

Temperature begins increasing after February. March is the hottest month with a mean daily maximum temperature of 37.1°C (98.8°F) and minimum of 24.6°C (76.3°F). The weather is oppressive throughout the hot season. After-noon thundershowers which are common in April and May bring a little relief to the otherwise sultry weather. The maximum temperature may go up to 41°C (105.8°F) on some days. With the onset of the southwest monsoon towards the end of May, the weather becomes appreciably cooler. After the withdrawal of the monsoon by the end of September, temperature increases again. The maximum and minimum temperatures during this time are 41.7°C (107.1°F) and 15.6°C (61.1°F) respectively.

Rivers

The 'Nilanathi' otherwise known as Bharathapuzha is the longest river in Kerala and flows into the Arabian sea. It is also called the Ponvani or Ponnani river. It is 215 km long but too shallow and rocky for navigation. It originates from the Anamalai hills and flows through Palghat and Ottapalam taluks. The important tributaries of Bharathapuzha are Gayathripuzha, Kannadi river, Korayar, Kalpathipuzha, Thuthupuzha and Kunthipuzha. Walayar and Malampuzha are also tributaries of the Bharathapuzha.

The Bhavani river springs from the Kundah mountains near Kudi-kadubetta in the Nilgiris. After entering Kerala it takes a right-angled turn and flows thereafter more or less northeastwards. Thus it takes a circuitous course through the Attapadi valley.

The Siruvani river originating from the Attapadi hills joins the Bhavani river at the boundary of Tamil Nadu. It flows into a deep legendary lake called Muthikulam at an elevation of about 1220 m. At Muthikulam a diversion canal, takes off water for the consumption of the Coimbatore Corporation, about 45 km away, traversing the ridge through a tunnel.

The western slopes of the Silent Valley drain into Kunthipuzha in a series of parallel valleys running east to west and are characterised by the grassy banks. Kunthipuzha originating at an elevation of about 2200 m in the north and flowing southward reaches the Mannarghat plains after a course of about 30 km through the mountain ranges. It traverses the entire length of the Silent Valley, bisecting it into a narrow western sector and a broad eastern sector. There are five main tributaries to Kunthipuzha, originating from near the eastern border and flowing east-west.

The ridges are steep and the tributaries form gorges between the ridges. The crest of these ridges are mostly occupied by grasslands. Forests occur on the slopes on either side and valleys forming forest belts on either side of the tributaries. Along the narrow western sector grasslands predominate and the forest areas are restricted to patches. Before reaching the plains Kunthipuzha flows through a narrow valley strewn with huge boulders. In the Walayar reserve there is hardly any perennial water source though there are many swift-flowing temporary streams and rivulets traversing the forests in many places during the rainy season.

PREVIOUS WORK

The Malabar Coast was the sole centre of the spices trade, particularly pepper, ginger and cardamom right from ancient times. It appears that even the early Europeans who came to India, lured by the coveted spices, were much impressed by the rich and diverse tropical flora of the Western Ghats, unknown in their temperate lands. The vast amount of literature accumulated over the years may be cited as an evidence to this effect. Garcia de Orta, a Portuguese, enumerated a list of medicinal plants of India in 1565. Between 1678 and 1703 van Rhee de, the then Dutch Governor of the Malabar Coast stationed at Cochin compiled the monumental *Hortus Malabaricus* with the help of the Carmelite monk Mathaeus and Itti Achuthan, a local physician, and several others and published the 12 volumes containing 794 copper plate engravings prepared at Amsterdam (1678 - 1703). It is one of the very important works in the history of taxonomic botany in that it formed a source material for Linnaeus to describe many Indian species and many of these plates are types of these Linnaean names. The utilitarian point of view of these forests of a European may be found in the statement of Buchanan (1807) when he observes that the most valuable production of these forests is their timber of which there are several good kinds but the teak is by far the most valuable. Robert Wight, a botanical prodigy, urged by his originality and far-sightedness, produced a series of books of illustrations on the South Indian plants in the mid 19th century (1830 - 1853). This was followed by the illustrative forester, Beddome who brought out similar books with illustrations (1868 - '74). Between 1872 - 1897, Hooker, yet another titan of taxonomy, assisted by many distinguished botanists published *The Flora of British India*, gathering all scattered works on Indian flora available till then. This flora was instrumental in accelerating further explorations and publication of provincial floras like (i) *Flora of the Presidency of Madras* by Gamble & Fischer (1915 - 1936) (ii) *Flora of the Presidency of Bombay* by Cooke (1901 - 1908) etc Other

workers like Blatter, Bourdillon, Dalzell, Fischer, Fyson, Rama Rao, Santapau and Talbot have made significant contributions to the knowledge of the flora of South India.

The exiguous information available on the flora of Palghat district is in the form of fragmentary publications. The Forest Department has periodically prepared the Working Plans for forest operation of timber extraction. The District Gazetteer also briefly deals with the flora and fauna. The sporadic collections made by Wight (1844-1848), Cleghorn (1852-1859), Beddome (1865-1873), Lawson (1883-1884), Barber (1898), Fischer (1914-1916), Rangachariar (1916), Jacob (1923-1925) and Raju & Rathinavelu (1929) are housed in the MH. As regards the publications with direct relevance to the flora of the district, mention may be made of Aiyar (1932) who has dealt with the sholas of the Palghat Division. Chandrasekharan (1962) has described the forest types of Kerala in general. Recently, Sebastine, Joseph, Ansari, Nair and Bhargavan have also made collections particularly from the Silent Valley and its environs.

MATERIALS AND METHODS

Several field trips, each ranging from 15-20 days, were undertaken from 1965-1980 to the various parts of the district covering all seasons and all types of forests of the two Forest Divisions *viz.*, Palghat and Nemmara. Collections were repeated till full data on flowering and fruiting were gathered. Detailed field notes were prepared for each species usually in the field itself. Characters and details that cannot be observed in a herbarium specimen such as height of the plant, nature of bark in case of trees, smell of the leaf/flower, colour of the flower/fruits, pubescence or secretions on the vegetative and reproductive parts, nature and position of flowers and inflorescences, characteristics of juvenile and senile leaves, associated plant species, nature of soil and other preference, if any, were noted down. Usually six specimens of the same plant were collected with a view of exchanging with other herbaria. For rare or otherwise interesting plants pickled flowers and fruits were also gathered. In instances like fruits, and plant parts of economic importance, specimens with the same field number were also collected for the museum. Live specimens particularly orchids and other plants of ornamental/biological interest were also gathered for introduction in the garden. After processing them in the conventional way (Fosberg & Sachet, 1965) like poisoning with alcohol saturated with mercuric chloride, pressing and repeated changes in blotters, all the specimens were got mounted, labelled and identified with the help of regional floras and old authentic herbarium

specimens in MH, CAL and a few at Kew. Most of the determinations were made using fresh plants. Critical studies of some of the species which posed difficulties were made with the help of a microscope in the laboratory. They were finally incorporated in the Madras Herbarium (MH), under the custody of the Botanical Survey of India, Southern Circle, Coimbatore. Data were also gathered from the old collections from this district after careful examination. Critical taxonomic notes were prepared as and when the species were identified and before incorporating them in the herbarium.

GENERAL ASPECTS OF THE VEGETATION

Champion and Seth (1968) have dealt with the many types of forests in Kerala. The following types are met with in Palghat district.

Tropical wet evergreen forests

This type of forest, the most magnificent among forests, occurs in the Silent Valley region and Karapara region of the Palghat and Nemmara Divisions respectively. All the characteristics that are attributed to the tropical wet evergreen forests (Richards, 1952) are observable here. Apart from other factors, the climatic factors such as heavy and prolonged rainfall, high relative humidity and good sunshine are responsible for the dense vegetation with a myriad plant species and their infra-specific categories. With their towering trees, twisting vines and dense undergrowth these forests are apparently impenetrable. The trees with various heights show stratification.

Top storey

The lofty trees of the top storey might reach a height of 45 m or more. Dominance of any one species is rarely met with. They may have a bole of 30 m high and 5 m or more in girth and the canopy is extremely dense. *Canarium strictum*, *Cullenia exarillata*, *Actionodaphne tadulingamii*, *Dipterocarpus indicus*, *Calophyllum apetalum*, *Palaquium ellipticum*, *Poeciloneuron indicum*, *Vateria indica*, etc. are some of the characteristic and common trees of this layer. Buttresses are seen in some of these giants such as *Dimocarpus longan*, *Elaeocarpus tuberculatus*, *Mesua nagassarium*, etc. However, the notion that the rain forest trees have pale, thin and smooth bark appears to be a fallacy as has been pointed out by Whitmore (1975). Members of the Dipterocarpaceae do exhibit a fissured bark. Cauliflory (ramiflory) is yet another feature exhibited by some of these trees, eg. *Baccaurea courtallensis*, *Artocarpus heterophyllus*, *Cullenia exarillata*, *Diospyros bourdillonii* etc. The leaves are broad, leathery, dark-green and generally with entire margins. The trees of the various layers are festooned by a variety of lianas. There are epiphytes of various kinds

on these trees, particularly orchids, ferns and aroids. Apart from these the stems and branches are often covered by lichens and mosses.

In the wake of the heavy showers of monsoon, due to the brightly coloured juvenile foliage, the landscape gradually takes on masses of variegated colour. The white and pink of *Mesua nagassarium*, the violet of *Poeciloneuron indicum* and *Mangifera indica*, the crimson of *Dimocarpus longan* (*Euphoria longan*), *Schleichera oleosa* and the yellow of *Canarium strictum*, *Diospyros bourdillonii*, *Polyalthia fragrans*, *P. cerasoides* are a striking feature of these forests.

The following are some of the more common species of this layer. *Aglaia anamallayanum*, *Artocarpus heterophyllus*, *A. hirsutus*, *Calophyllum austroindicum*, *Canarium strictum*, *Chrysophyllum roxburghii*, *Cinnamomum sulphuratum*, *C. wightii*, *Dimocarpus longan*, *Diospyros nilagiricum*, *Elaeocarpus munronii*, *E. tuberculatum*, *Garcinia gummi - gutta*, *Hopea ponga*, *Hydnocarpus alpina*, *Lophopetalum wightianum*, *Meiogyne ramarowii*, *Mesua nagassarium*, *Mangifera indica*, *Meliosma pinnata* ssp. *arnottiana*, *Myristica dactyloides*, *Persea macrantha* and *Polyalthia coffeoides*.

Middle storey or Second storey

Though this layer consists of trees less in height than in the top storey, there may be overlapping of some of the species occurring in the top canopy. The usual components of this layer are : *Achronychia pedunculata*, *Actinodaphne malabarica*, *Antidesma menasu*, *Agrostistachya meeboldii*, *Baccaurea courtallensis*, *Bischofia javanica*, *Breynia patens*, *Canthium dicoccum* var. *umbellatum*, *Cinnamomum iners*, *C. macrocarpum*, *C. sulphuratum*, *Cryptocarya bourdillonii*, *Drypetes elata*, *Diospyros candelleana*, *Fahrenheitia zeylanica*, *Garcinia morella*, *Glochidion ellipticum*, *G. neilgherrense*, *G. malabaricum*, *Gomphandra tetrandra*, *Grewia tiliifolia*, *Holarrhena pubescens*, *Homalium zeylanicum*, *Ficus beddomei*, *F. drupacea* var. *pubescens*, *F. talbotii*, *Litsea floribunda*, *L. oleoides*, *Miliusa wightiana*, *Macaranga indica*, *Meliosma simplicifolia*, *Meiogyne ramarowii*, *Mallotus beddomei*, *Knema attenuata* etc.

Third storey

This layer usually consists of small trees and shrubs. The general composition of this layer are : *Alstonia venenata*, *Antidesma menasu*, *Ardisia solanacea*, *Boehmeria glomerata*, *Breynia retusa*, *B. scandens*, *B. vitis - idaea*, *Capparis baduca*, *Calamus rotang*, *Cayratia pedata*, *Clerodendrum viscosum*, *Grewia disperma*, *Helicteres isora*, *Indigofera colutea*, *Ixora cuneifolia*, *Isonandra lanceolata*, *Lasianthus jackianus*, *Laportea cremulata*, *Leea indica*, *Memecylon heyneanum*, *Mussaenda glabrata*, *Maesa*

indica, *Microtropis latifolia*, *Nilgirianthus heyneanus* var. *neesii*, *N. foliosus*, *Pavetta hispidula*, *P. tomentosa*, *Pogostemon benghalensis*, *Saprosma fragrans*, *Sauropus androgynus*, *Solanum stramoniifolium*, *S. gigantium*, *Syzygium benthamianum*, *S. hemisphericum*, *S. laetum*, *Thottea siliquosa* and *Wendlandia thyrsoides*.

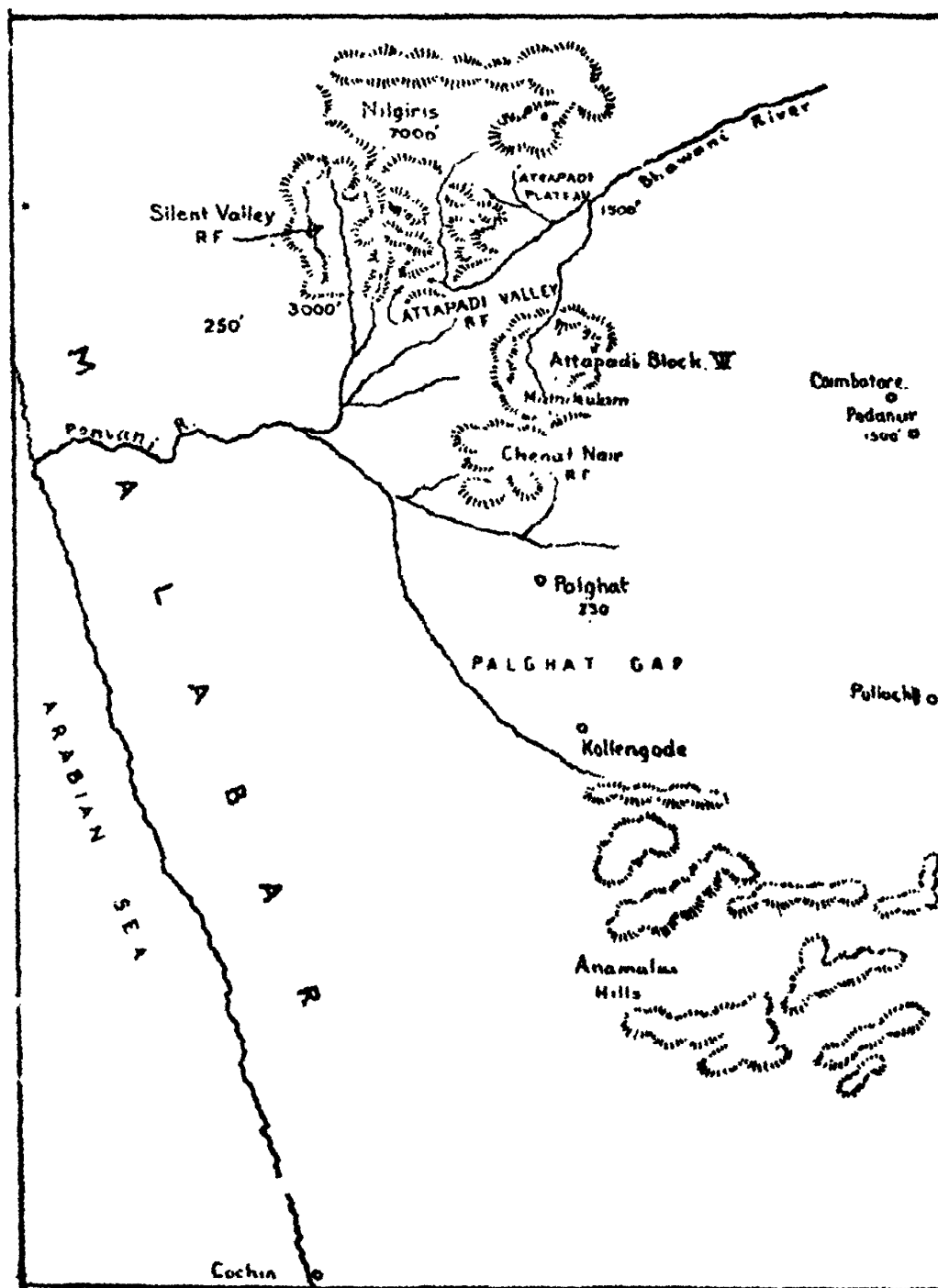
The ground flora is sparse, occurring in certain places where there is penetration of sunlight. However, where the canopy is extremely dense there may not be any undergrowth at all. The following are some of the common components of the ground cover : *Abelmoschus angulosus*, *Arisaema leschenaultii*, *Anaphyllum wightii*, *Begonia malabarica*, *Blumea belangeriana*, *Dichrocephala integrifolia*, *Impatiens kleinii*, *Laggera pterodonta*, *Lepianthus umbellata*, *Murdannia esculenta*, *M. lanuginosa*, *Neurocalyx calycina*, *Ophiorrhiza hirsuta*, *Pellionia heyneana*, *Pilea melastomoides*, *Rhynchoetechum permolle*, *Sarcandra chloranthoides*, *Zingiber montanum* etc. There are also many species of ferns in the ground layer.

Aiyar (1932) mentions the following associations of tree species in the tropical rain forests : 1. The *Cullenia Palaquium* Association, 2. The *Palaquium Mesua* Association, 3. The *Poeciloneuron—Palaquium* Association, 4. The Reed—*Calophyllum* Association, 5. The Reed—*Poeciloneuron* Association, 6. The *Mesua—Calophyllum* Association, 7. The *Vateria—Cullenia* Association and 8. The *Vateria—Mesua* Association.

Most of these communities mentioned by Aiyar (1932) for the then Palghat Division are still observable to a limited extent in the present area of study. However, they are not that sharp and distinct as has been stated by Aiyar (1932). It might be the result of the degradation of these forests due to human interference in the past five decades. The association of reed with either *Calophyllum* or *Poeciloneuron*, if any, is not prominent.

Climbers

Gigantic climbers or lianas and twiners or climbers on the lofty trees of the evergreen forest, comprising one of the synusiae (Richards, 1952 ; Whitmore, 1975) is a common feature. They belong to diverse families. The curious gymnosperm *Gnetum ula* is of common occurrence. Some of the other common species are *Butea parviflora*, *Canavalia gladiata*, *Cayratia pedata*, *Cissus repanda*, *C. glauca*, *Connarus sclerocarpus*, *Combretum latifolium*, *Dioscorea oppositifolia*, *D. tomentosa*, *D. bulbifera*, *Entada rheedii*, *Glycine wightii*, *Gymnopetalum wightii*, *Jasminum rottlerianum*, *Loeseneriella arnottiana*, *Naravelia zeylanica*, *Pothos scandens*, *Tetragium stigma sulcatum*, *Tiliacora acuminata*, *Trichosanthes bracteata* and *Zanonia indica*.



Scale 1"=32 Miles (approx)

MAY 1932.

Sholas of Palghat district

Epiphytes

These form a dependent synusia on the lofty trees. They perch on the branches and trunks of the trees. They mostly belong to the skiophytic or shade loving group, adapted to the cooler, darker and moister microclimates within the forest canopy. They also belong to diverse groups. Members of the Orchidaceae, ferns and some aroids are common. *Aeschynanthus perrottettii* with scarlet handsome flowers, *Belosynopsis vivipara* with radical and cauline leaves, *Medinilla beddomei* with fleshy leaves, *Remusatia vivipara* with bulbiferous shoots are notable among them apart from the many epiphytic orchids dealt with separately. A rather special group of the synusia of epiphytes are the hemiparasitic epiphytes which are attached to the host tree by haustoria. Most of the Loranthaceae belong here. Plants like *Dendrophthoe falcata*, *Helicanthes elasticus*, *Helixanthera intermedia*, *Macrosolen capitellatus*, *M. parasiticus*, *Scurrula cordifolia*, *S. parasitica*, *Viscum angulatum*, *V. nepalense* etc. are of common occurrence. However, root parasites like *Aeginetia indica*, *A. peduncularis*, *Balanophora fungosa* spp. *indica* and *Striga angustifolia* form part of the ground floor vegetation.

In certain places on the banks of the Kunthipuzha river, large populations of *Arenga wightii*, *Schumannianthus virgatus*, *Pinanga dicksonii* etc. are found. *Ochlandra* species also occurs in large patches in this area which was always found in vegetative condition.

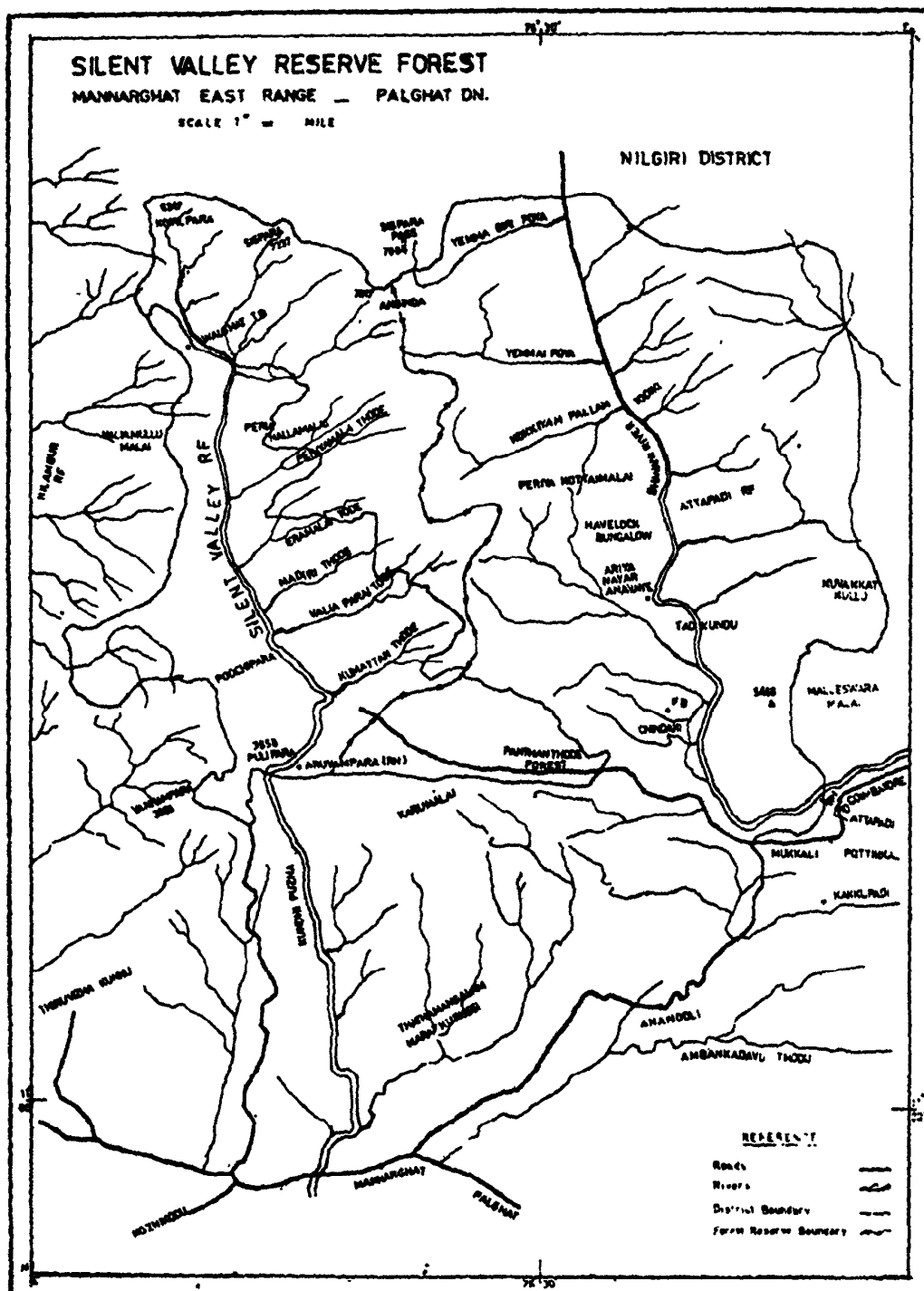
Herbaceous flora

Though the ground cover in the upper ghat is very sparse, it is very rich in other lower regions of the district. Common herbs that occur in the area are *Abelmoschus angulosus*, *Begonia malabarica*, *B. floccifera*, *Blumea belangeriana*, *B. mollis*, *Cassia mimosoides*, *Cleome monophylla*, *Crotalaria retusa*, *Canscora decurrens*, *Curculigo orchioides*, *Cyanotis cristata*, *Centella asiatica*, *Desmodium gangeticum*, *Erigeron canadensis*, *Exacum pumilum*, *Impatiens kleinii*, *I. scapiflora*, *I. viscosa*, *Kalanchoe floribunda*, *Laggera pterodonta*, *Neurocalyx calycina*, *Ophiorrhiza mungos*, *O. prostrata*, *Osbeckia aspera* var. *wightiana*, *Polygala elongata*, *P. rosmarinifolia* and *Sonerila rotundifolia*.

In the forest clearings weeds colonise as pioneers and are followed by shrubby species of *Wendlandia*, *Laportea* and other fast-growing species of *Acacia*, *Hypericum*, *Leea*, *Macaranga*, *Trema* and *Lantana*.

The Silent Valley

The Silent Valley is about 45 km north of Mannarghat, the nearest town. The entire forest is on a plateau. The extent of this reserve is



about 8,952 hectares. It is a unique tract of forest and is one of the few tropical rainforests that still remain relatively undisturbed by human interference. The tropical rainforests are the richest expressions of life that have evolved on this planet having a continuous history of several million years of evolution. It is important for the survival of certain rare and endangered species. It is unique in its flora and fauna. Its flora is so diverse and complex that plant breeders would find it an invaluable gene pool. The Silent Valley area remains in a near-virgin state for ages because of its inaccessible and impenetrable nature and lack of means of communication. In the Silent Valley and in Karapara river forests, the free flowing rivers have a natural shoreline vegetation which provides habitat for many species of wildlife. Shore line vegetation offers nesting sites for various species of birds. The importance of conservation of these forests has been repeatedly voiced by conservationists.

Tropical moist deciduous forests

This type of forests rises from the plains to an elevation up to 250 m on the western or southern slopes. Depending on the moisture in the soil and the subjection of the forest to shifting cultivation in the past, it may be met with up to 600 m or more. This is a closed, high forest with trees commonly 20-30 m or more in height. However, the dominant species are mostly deciduous ones though often briefly so when compared with the dry deciduous forest. Although intimate mixture of species is the rule, relatively small number of species together form the greater part of the canopy and relatively pure associations are frequently met with. Some evergreen dominants may be intermixed but they are few. The evergreen habit is more developed in the lower storey giving the forest as a whole a more or less evergreen appearance round the year.

This type of forest occurs in Mukkali area and Siruvani western slopes of the Palghat Division and Ayyappankoil area and Seetharkandi area of the Nemmara Division. The components of this type are *Acacia torta*, *Alstonia scholaris*, *Anamirta cocculus*, *Bambusa arundinacea*, *Butea parviflora*, *Baccaurea courtallensis*, *Begonia floccifera*, *Cinnamomum macrocarpum*, *Celtis cinnamomea*, *Canthium rheedii*, *Connarus wightii*, *Cyathocalyx zeylanicus*, *Bischofia javanica*, *Cycas circinalis*, *Costus speciosus*, *Entada rheedii*, *Callicarpa tomentosa*, *Fahrenheitia zeylanica*, *Phyllanthus emblica* (*Emblia officinalis*), *Gardneria ovata*, *Grewia tiliifolia*, *Helicteres isora*, *Holigarna grahamii*, *Impatiens viscosa*, *Jasminum azoricum*, *J. rottlerianum*, *Kydia calycina*, *Litsea glabrata*, *Miliusa tomentosa*, *Mallotus philippensis*, *Macaranga peltata*, *Oroxylum indicum*, *Pterygota alata*, *Pterospermum diversifolium*, *Scleropyrum pentandrum*, *Syzygium mundagam*, *Trewia nudiflora*, *Terminalia paniculata*, *T. bellirica* etc.

Some of the commoner climbers and epiphytes of the tropical wet evergreen forest are also found to occur here. As the canopy is not that dense and the consequent penetration of sunlight, the ground layer is very well developed when compared with the wet evergreen forest.

Dry deciduous forests

This type of forests is characterised by the species deciduous during the dry season usually for several months, though some for a short period. Most of the species also occur in the moist deciduous forest where they reach the maximum development. The height of the trees usually varies from 10 to 20 m. The number of species is much less than in the foregoing types. Bamboos are often present but are not luxuriant. Canes and palms are usually absent. Climbers are comparatively few but include large woody species.

This type of forests occurs in Walayar area, Agali - Kottathora area and Anamooly slopes of the Palghat Division and Pothundy slopes and Mangalam area of the Nemmara Division.

The most characteristic trees are *Anogeissus latifolia*, *Albizia chinensis*, *A. odoratissima*, *Butea monosperma*, *Cassia fistula*, *Cochlospermum religiosum*, *Dillenia pentagyna*, *Dalbergia lanceolaria*, *D. latifolia*, *D. sissooides*, *Garuga pinnata*, *Gmelina arborea*, *Givotia rottleriformis*, *Hymenodictyon obovatum*, *Lagerstroemia microcarpa*, *Lannea coromandelica*, *Melia dubia*, *Mitragyna parvifolia*, *Pterocarpus marsupium*, *Schleichera oleosa*, *Sterculia guttata*, *S. urens*, *Tectona grandis*, *Terminalia arjuna*, *T. paniculata*, *T. bellirica*, *T. crenulata* and *Xylia xylocarpa*.

Though the forests provide many useful things to man there are dangers that lurk in these forests mostly unknown to the unwary explorer. Apart from the danger from a variety of wild animals like the elephant and ferocious giant cats, poisonous snakes, blood sucking leeches and poisonous insects, scorpion etc., there are many plants with stinging hairs, acrid juice/latex, prickles and thorns which when come in contact would be painful or even fatal. The stinging hairs of *Laportea crenulata* are irritant, itching especially when the affected part comes in contact with water. It might develop fever with violent sneezing in certain individuals. Even the elephant avoids it hence the name the 'elephant nettle'. The acrid juice of *Holigarna grahamii* can develop fever and blisters on skin. Similarly the stinging hairs on the fruits of *Mucuna hirsuta*, *M. monosperma* *M. pruriens*, *Sterculia urens* and the hispid stinging hairs on the leaves and stems of *Tragia muelleriana* are irritant and itching. Latex of some plants especially of some members of the Asclepiadaceae and Euphorbiaceae can impair the eye sight. Some of the fruits with hooks, bristles and awns may stick to the clothes as well as the skin and could give a lot of dis-

comfort to the collectors. Hooked spines of some of the species of *Acacia*, *Zyziphus*, *Toddalia*, *Solanum* etc. if got into the flesh could indeed be painful and vexing.

Grasslands

In grassy slopes small trees stand apart singly or in small groups. Species of *Phoenix* and *Phyllanthus emblica* are usually seen. Other common components of these grassy slopes are *Aeginatia pedunculata*, *Canscora bicolor*, *Crotalaria nana*, *C. salvifolia*, *Desmodium motorium*, *Exacum sessile*, *Leucas mollissima* var. *scaberula*, *Pecteilis gigantea*, *Pleocaulus sessilis*, *Smithia blanda*, *Tephrosia pulcherrima*, *Polygala rosmarinifolia* etc. The common grasses found in these grasslands are *Arundinella ciliata*, *A. mesophylla*, *Capillipedium huegelii*, *Chrysopogon hackelii*, *Cymbopogon flexuosus*, *Eleusine indica*, *Eragrostis cilianensis*, *E. pilosa*, *E. tenuifolia*, *Garnotia schmidii*, *Isachne gracilis*, *I. nilagiricum*, *Oplismenus compositus*, *Panicum gardneri*, *Paspalum conjugatum*, *Pennisetum pedicellatum*, *Setaria palmifolia*, *Sporobolus piliferus*, *Tripogon bromoides* etc.

Orchids

The forests of this district with a heavy and prolonged rainfall both from the southwest and northeast monsoons coupled with bright sunlight almost throughout the year have been a haven for epiphytic orchids. High atmospheric humidity which is prevalent most of the year is a pre-requisite for the germination, growth and multiplication of these orchids. The inaccessibility of the forest, presence of wild animals, poisonous snakes and blood sucking leeches and the unreachable height of branches of lofty trees on which they usually perch have also enabled them to thrive well without any unwanted human interference. In spite of these hurdles every attempt was made to collect as far as possible the maximum number of terrestrial and epiphytic orchids. About 70 species of orchids belonging to 44 genera could be collected from this district and studied.

Eulophia hirsuta, a terrestrial orchid with lovely yellow flowers and inhabiting open grassy slopes, and *Porpax chandrasekharanii*, a pseudobulbous, epiphytic orchid with dull white flowers are the two new finds from this district.

Endemic or otherwise rare species

Orchids like *Bulbophyllum fischeri*, *Chrysoglossum maculatum*, *Cottonia peduncularis*, *Dendrobium heterocarpum*, *D. nanum*, *Didymoplexis pallens*, *Disperis zeylanica*, *Eria albiflora*, *Habenaria multicaudata*, *Malleola gracilis*, *Oberonia santapauli*, *Pachystoma senile*, *Porpax jerdoniana*, *Tropidia angulosa* have been collected from the forests of this district.

Species like *Oberonia brachyphylla*, so far known from North Canara only, *Smithsonia straminea* (from Hassan district, Karnataka), *Trias stocksii* (from North Canara), *Eulophia emiliana* (from Hassan district), *Aphyllorchis prainii* (from Naga hills, Eastern Himalayas), *Habenaria furcifera* (from Northern and Northeastern Bombay), etc. have also been gathered from the district and they are additions to the flora of the erstwhile Presidency of Madras.

Among the terrestrial orchids, species of *Habenaria* and among the epiphytic orchids, species of *Dendrobium* and *Oberonia* predominate. *Pecteilis gigantea* (= *Platanthera sussannae*) an elegant, tall orchid of grassy slopes, having ivory white, large, showy flowers and *Acanthophippium bicolor*, another very robust orchid with gibbous, purple tipped yellow flowers on lateral short racemes, could be collected in the dense forests of the Silent Valley R.F. *Arundina graminifolia* is another pretty, terrestrial orchid which resembles a tall grass while in vegetative condition, but the large, mauve flowers in terminal racemes attract even an otherwise not so attentive collector from a long distance. This has been collected from the grassy rocky slopes near Ayyappankoil area in the Nemmara Division.

Acampe praemorsa with its fragrant yellow flowers in racemes, *Aerides cylindricum* with its terete leaves, *Bulbophyllum neilgherrense* with its yellow flowers in drooping racemes, *Calanthe masuca*, a stout terrestrial orchid preferring shady places, *Cymbidium aloifolium* with its pendulous, long racemes of dark, pinkish flowers, *Dendrobium barbatulum*, a tufted epiphyte leafless when in bloom, *Eulophia nuda*, a tall tuberous herb with purple as well as greenish flowers, *Habenaria crenifera*, with its snow-white flowers mimicking a butterfly, *Oberonia brunoniana*, a robust, epiphytic herb, *Rhynchostylis retusa*, with its pinkish, showy flowers in dense, pendulous racemes, *Tainia bicornis*, with its solitary leaves and yellow flowers in long racemes and *Vanda testacea* an epiphyte are the common orchids of this district.

Epipogium roseum, a curious orchid with a disjunct distribution, occurring both in the Himalayas and the Western Ghats, has been collected from the Silent Valley R.F. It is a leafless, tuberous saprophytic orchid producing long inflorescences with succulent axis and many creamy white, drooping flowers. The inflorescence lasts for a few days only within which time the dispersal of the seeds is effected.

Rare and interesting plants

The fact that many novelties and rare or otherwise interesting plants have been discovered indicates that the flora of the district is very rich and diverse. Some plants reported from elsewhere in the Western Ghats

have been collected only from the present area of study. For instance *Amorphophallus bulbifer* (Araceae) reported from the Rumphia hills (Orissa), the Nadugani Ghat (Wynaad) and South Malabar has been collected from the Mukkali forest of this district. *Kalanchoe glandulosa* (Crassulaceae), so far thought to be confined only to the Mysore hills and Kollegal in Karnataka, has been recorded from the Karasuryamalai forest of the Nemmara forest division. *Stachyphrynium spicatum* (Marantaceae) collected by Beddome (in the last century ; no specimen in MH) from the Malabar has not been traced from any other place in the Western Ghats so far except from Mukkali forest of the Palghat forest division. Likewise *Antistrophe serratifolia* (Myrsinaceae), considered to be endemic to the Anamalai Hills of Tamil Nadu and thought to have been lost for science in the past has been found to occur in this area especially in the Silent Valley region. Another plant, belonging to Caesalpiniaceae, *Cynometra travancorica* collected by Beddome from Wynaad in 1873 and 1880 and Barber from the same locality in 1903 could be located in Vattapara Inchikuzhi of Siruvani western slopes which is far away from the above regions. Following are some of the species whose occurrence is rare in this district : *Impatiens modesta*, *I. scabriuscula*, *Miliusa velutina*, *Polyalthia fragrans*, *Euonymus dichotomus*, *Loesneriella bourdillonii*, *Salacia beddomei*, *Ventilago bombaiensis*, *Crotalaria multiflora*, *C. scabrella*, *Derris thothathrii*, *Desmodium motorium*, *D. triflorum*, *Goniogyna hirta*, *Rhynchosia rufescens*, *Tephrosia canarensis*, *T. wynaadensis*, *Vigna grahamiana*, *V. vexillata*, *Mezoneuron cucullatum*, *Cassia leschenaultiana*, *Kalanchoe laciniata*, *Eugenia indica*, *Syzygium lanceolatum*, *Medinilla beddomei*, *Sonerila rotundifolia*, *Begonia integrifolia*, *Solena amplexicaulis*, *Zanonia indica*, *Zehneria thwaitesii*, *Aralia malabarica*, *Polyscias acuminata*, *Geophila repens*, *Mycetia acuminata*, *Psychotria congesta*, *Saprosma fragrans*, *Tarenna nilagirica*, *Vernonia conyzoides*, *Antistrophe serratifolia*, *Ardisia pauciflora*, *Xantolis tomentosa* var. *elengioides*, *Diospyros buxifolia*, *D. paniculata*, *D. tomentosa*, *D. toposia*, *Symplocos foliosa*, *S. pulchra*, *Myxopyrum serratum*, *Anodendrum rhinosporum*, *Chilocarpus atrovirens*, *Hunteria corymbosa* var. *roxburghiana*, *Ceropegia intermedia*, *C. thwaitesii*, *Hoya ovalifolia*, *Toxocarpus palghatensis*, *Strychnos wallichiana*, *Argyreia sericea*, *Ipomoea staphylina*, *I. wightii*, *Torenia hirsuta*, *T. travancorica*, *T. vagans*, *Utricularia bifida*, *Epithema carnosum* var. *hispida*, *Andrographis alata*, *Gymnostachyum canescens*, *Mackenzia caudata*, *Nilgirianthus asper*, *N. barbatus*, *N. beddomei*, *Xenacanthus pulneyensis*, *Lippia alba*, *Coleus malabaricus*, *Rabdosia wightii*, *Pogostemon purpurascens*, *Polypleurum dichotomum*, *Willisia selaginoides*, *Helicia nilagirica*, *Croton malabaricus*, *Glochidion neilgherrense*, *Dorstenia indica*, *Elatostema surculosum*, *Lagenandra ovata*, *Theriophonum fischeri*, *Cyperus compressus*, *Pycnus pumilus*, *Brachiaria milliformis*, *Eragrostis gangetica*, *E. pilosa*, *Eulalia trispicata*, *Garnotia tenella*, *Ischaemum nilagiricum*, *Jansenella griffithiana* and *Oryza rufipogon*.

Endemism

The species rich tropical forests of the Western Ghats exhibit a high degree of endemism. They also harbour many rare and interesting plants. In Palghat District, the rich tropical forests are well known for their endemic and rare species. Subramanyam and Nayar (1974) report about 90 characteristic species as endemic to the whole of the Western Ghats. The area of Palghat district when compared with the Western Ghats which stretch from Kanyakumari (Cape Comerin) in Tamil Nadu to the mouth of the river Tapti in Gujarat, is just a fragment. When viewed against this backdrop, the occurrence of 65 endemic species from the district might well testify the great significance of the flora of the district.

Some of the endemic species collected from the district are *Actinodaphne tadulingamii*, *Aglaiia anamallayana*, *A. lawii*, *Antistrophe serratifolia*, *Apodytes dimidiata*, *Arenga wightii*, *Arundinella mesophylla*, *Baccaurea courtallensis*, *Bulbophyllum fischeri*, *B. neilgherrense*, *B. tremulum*, *Calophyllum apetalum*, *C. austroindicum*, *Chilocarpus atrovirens*, *Ceropegia intermedia*, *Cynometra travancorica*, *Dendrobium nanum*, *Elaeocarpus tuberculatus*, *Dipterocarpus indicus*, *Erythrophalum populifolium*, *Garcinia gummi-gutta*, *Garnotia arundinacea*, *Ficus macrocarpa*, *Isonandra lanceolata*, *Ischaemum rangacharianum*, *Knema attenuata*, *Leucas prostrata*, *Chionanthes mala-elengi*, *Myxopyrum serratum*, *Nothopodytes nimmoniana*, *Palaquium ellipticum*, *Pittosporum dasycaulon*, *Poeciloneuron indicum*, *Pouzolzia wightii* var. *caudata*, *Rapanea wightii*, *Thottea siliquosa*, *Vateria indica* and *V. macrocarpa*.

Aquatic plants

Rotula aquatica is abundant on Bhavani river bank. *Blyxa echinosperma* is abundant in still waters in paddy fields. *Hydrilla verticillata* and *Ottelia alismoides* are also commonly found in still waters. *Nelumbo nucifera* is cultivated in tanks near Nemmara for the sacred lotus flowers as well as for the leaves. Other species like *Nymphaea nouchali*, *N. pubescens*, *Eichhornia crassipes* are abundant in tanks near Kollenkode town. *Typha angustata* is found as pure formations along Walayar and Malampuzha canals. *Cryptocoryne retrospiralis*, with elongate spathes is found in abundance in the sandy beds of Bhavani river. *Lagenandra ovata*, *L. meeboldii* etc. are found along streams. *Spirodela polyrrhiza* covering the water surface giving an appearance of a green mat over still waters, *Pistia stratiotes*, a floating herb and *Nymphoides cristata* are abundant in certain tanks in the plains.

HILL TRIBES

There are many tribal settlements in the hill forest areas of the Palghat Division. Anamooly, Anavayee, Chindaki, Agali, Attapadi, Karivara, Kakkupadi, Kadugumannu, Thadikkundu, Thodukki, Sholayur, Siruvani, Walayar and Dhoni are some of the tribal villages. Irulas, Mudugas and Kurumbas are the main subcastes among the tribal populations. Irulas and Mudugas are agricultural communities whereas Kurumbas are forest labourers. Kadars are another tribe, who inhabit the Sirunelli Estate areas, Seetharkandi and Minnampara, all about 10 km west of Parambikumam. Most of them are forest labourers and some of them are mahouts who are good at trapping and taming elephants. The Kerala State Government has provided permanent quarters in the above villages and they are engaged in forest operational works. They collect honey and other minor forest products for the contractors and eke out a living. There are a few schools in the above villages for the children of these tribal people.

ENVIRONMENTAL FACTORS

Due to the influence of man and domestic animals, the vegetation in general has been affected very much. Forests have been destroyed and eucalyptus, teak etc. are introduced in some of the forest areas by the Forest Department. Many hill tribe settlements have sprung up along the fringes of the forests. The tribal people used to practice shifting cultivation in the past by felling and burning vast areas of the forests and cultivating crops like ragi, redgram, sorghum etc. Now in many forest slopes terrace cultivation is being practised. Such terrace cultivation is found along the slopes of Agali, Kottathora, Thavalam area of the Attapadi blocks of the Palghat Division. In Sirunelli estate area of the Nemmara Division also this type of cultivation is in practice. But at present the forest department has allotted land to these tribal people with the hope of getting the forest protected without further depletion. Further, the Forest Department after removing the ground growths like shrubs, herbs and other climbers, raise cardamom, tea and coffee plantations, on a co-operative basis for the welfare of the tribal people in Mukkali, Chindaki, Karuvara, Thadikkundu and Anavayee areas of Mannarghat Range. Most of them are employed in the estate/plantation works. Further they are also engaged in cutting bamboos, canes etc. from the interior forests and bringing them to the point where transport facilities are available, and in operational works of forest plantations like digging pits, transporting the seedlings, manure, planting the seedlings, watering, weeding and finally harvesting the forest products. Human activities are on the increase day by day in these forests as could be seen during the explorations

of the author between 1965 and 1980, leading to reduction in the area of the forests. Thick primary forests have been reduced to secondary ones and even to barren lands at several places near Mukkali, Panthanthode, Karivara and Chindaki area. The overall effects of such degradation and disappearance of forests, particularly on the inter dependent species, more so on the arboreal and other mammals are yet to be assessed by the experts concerned to focus the attention of the administrators to save the forests.

Grazing and browsing of domestic animals over forest areas has also of late increased much in Dhoni, Walayar, Thavalam and Kottathora area of the Palghat Division and Pothundi and Mangalam slopes of the Nemmara Division. Apart from this, livestock trampling of the seedlings adversely affect regeneration of forest species to a great extent.

Large scale collection of firewood by local villagers around Mukkali slopes near Anamooly village, Dhoni forest, Pothundy slopes and Mangalam dam area for selling in nearby towns is a common sight. This leads to a great depletion of forests. Setting fire to the undergrowths in summer by cattle owners to get a fresh flush of grass growth sometimes leads to the destruction of large forests and wildlife. But the Forest Department has been seeking the cooperation of the public to help in saving the forests from such devastations.

PLANTS OF ECONOMIC IMPORTANCE

Timber trees

The rich forests of this district provide many useful products. Many trees useful for construction, furniture, railway sleepers and several other purposes grow in the forests. Some of them which yield very good timber of commerce are *Artocarpus heterophyllus*, *A. hirsutus*, *Cullenia exarillata*, *Diospyros bourdillonii*, *Dipterocarpus indica*, *Elaeocarpus tuberculatus*, *Mesua nagassarium*, *Hopea ponga*, *Calophyllum apetalum*, *Palaquium ellipticum* and *Vateria indica*.

In addition to this there are several other economically important trees found in these forests. For example, *Albizia chinensis*, *A. odoratissima*, *Aphanamixis polystachya*, *Ceiba pentandra*, *Bombax insigne*, *Dalbergia lanceolaria*, *Haldina cordifolia*, and *Xylia xylocarpa* are common and these are very useful for match and plywood industries as well as for making packing cases (Dealwood cases) etc.

Fibres

Fibres used for making very durable ropes can be obtained from the species of *Aglaia*, *Abelmoschus*, *Agave*, *Acacia*, *Hibiscus*, *Sterculia*, *Kydia*, *Tetrastigma*, *Bauhinia* etc. Apart from the husks of coconuts which provide the well known coir, the petioles of palmyra leaves are also used to make ropes and other fibre products. Other fibre yielding plants include *Helicteres isora*, *Grewia tiliifolia* and *Rourea minor* which are not exploited properly.

Edible tubers and fruits

The hill tribes depend upon the wild tubers of *Dioscorea* species. Wild edible fruits are obtained from the following plants : *Antidesma menasu*, *A. diandrum*, *Alangium salvifolium*, *Artocarpus heterophyllus* (also cultivated), *Baccaurea courtallensis*, *Calamus rotang*, *Canthium travancoricum*, *Ficus racemosa*, *Flacourtia indica*, *Mangifera indica* (largely cultivated also), *Nymphaea pubescens* (seeds), *Phoenix humilis* var. *pedunculata*, *Phyllanthus emblica*, *Rubus micropetalus*, *R. wightii*, *Syzygium cuminii*, *Physalis minima*, *Solanum nigrum*, etc.

Medicinal plants

Though most of the plants are useful to mankind in one way or other, the following species are medicinally important whose curative properties have been well established : *Aegle marmelos*, *Adhatoda zeylanica*, *Acalypha racemosa*, *Alangium salvifolium*, *Anamirta cocculus*, *Aristolochia indica*, *Boerhavia diffusa*, *Bauhinia racemosa*, *Biophytum sensitivum*, *Buddleia asiatica*, *Cardiospermum helicacabum*, *Cassia fistula*, *Canarium strictum*, *Centella asiatica*, *Costus speciosus*, *Datura metel*, *Entada rheedii*, *Ficus asperrima*, *Gloriosa superba*, *Gmelina arborea*, *Gymnema sylvestre*, *Helicteres isora*, *Hemidesmus indica*, *Holarrhena pubescens*, *Iphigenia indica*, *Ichnocarpus frutescens*, *Jatropha curcas*, *Knema attenuata*, *Momordica dioica*, *Myristica dactyloides*, *Murraya paniculata*, *Naregamia alata*, *Physalis minima*, *Plumbago zeylanica*, *Rauvolfia serpentina*, *Solanum nigrum*, *S. torvum*, *Scilla indica*, *Tinospora cordifolia*, *Terminalia bellirica*, *T. chebula*, *Vitex negundo* etc.

Avenue trees and other cultivated plants

Some quick growing trees with spreading crowns are usually planted on either sides of the roads. The common avenue trees of this district are *Delonix regia*, *Syzygium cuminii*, *Ficus benghalensis*, *Mangifera indica*, *Azadirachta indica*, *Pongamia pinnata*, *Polyalthia longifolia*, *Samanea saman*, *Thespesia populnea* etc.

The Agricultural Research Station for fruits, vegetables and spices, commonly known as the Orange Farm at Padagiri in Nelliampathy Ghat is run by the Government of Kerala. Apart from oranges, a wide variety of vegetables are grown and sold to the public. Orange squash, jam etc. are the main products of the farm. Coffee, tea, cardamom and pepper are cultivated in large areas in the district. Groves of *Areca catechu*, *Cocos nucifera*, *Anacardium occidentale*, *Hevea brasiliensis* are commonly found in and around villages.

Tapioca (*Manihot esculenta*), many varieties of banana (*Musa* spp.), many kinds of vegetables, pulses, groundnut, tobacco, turmeric, ginger etc. are cultivated in many places in the district. Papaya is usually cultivated as a kitchen garden plant. Several varieties of paddy (*Oryza sativa*) and sugar cane (*Saccharum officinarum*) are the main crops in the plains. Ragi (*Eleusine coracana*), sorghum and redgram (*Cajanus cajan*) are the main crops of the hill tribes.

The Kerala State Forest Department has raised plantations of eucalyptus, teak (*Tectona grandis*), *Dalbergia paniculata*, bamboo (*Bambusa arundinacea*) etc. in Anavayee, Karivara, Chindaki, Panthanthode, Kakkupadi, Agali slopes, Sholaiyur slopes, (Palghat Division) and Pothundi slopes and Mangalam area (Nemmara Division).

STATISTICAL DATA

The data presented hereunder are based on the intensive and extensive explorations conducted in the district by the author as well as others. A total of about 1355 species belonging to 732 genera and spread over 146 families of flowering plants have been collected and studied. The following are the dominant families representing more than 20 species.

1. Fabaceae	(132)	7. Cyperaceae	(48)
2. Poaceae	(81)	8. Asteraceae	(38)
3. Orchidaceae	(73)	9. Lamiaceae	(32)
4. Euphorbiaceae	(61)	10. Commelinaceae	(29)
5. Acanthaceae	(59)	11. Convolvulaceae	(25)
6. Rubiaceae	(52) and	12. Asclepiadaceae	(24)

Likewise the dominant families having more than 20 genera are :

1. Fabaceae	(58)	5. Acanthaceae	(29)
2. Poaceae	(53)	6. Asteraceae	(28)
3. Orchidaceae	(42) and	7. Rubiaceae	(28)
4. Euphorbiaceae	(32)		

A comparison of these dominant families with those of Gamble & Fischer for the Flora of the Presidency of Madras and Hooker for the Flora of British India bring out certain interesting aspects.

Palghat District (Present study)	Flora of the Presidency of Madras by Gamble & Fischer	Flora of British India by J.D. Hooker
1. Fabaceae	1. Fabaceae	1. Orchidaceae
2. Poaceae	2. Poaceae	2. Fabaceae
3. Orchidaceae	3. Rubiaceae	3. Poaceae
4. Euphorbiaceae	4. Acanthaceae	4. Rubiaceae
5. Acanthaceae	5. Euphorbiaceae	5. Euphorbiaceae
6. Rubiaceae	6. Orchidaceae	6. Acanthaceae
7. Cyperaceae	7. Asteraceae	7. Asteraceae
8. Asteraceae	8. Cyperaceae	8. Cyperaceae
9. Lamiaceae	9. Lamiaceae	9. Lamiaceae
10. Commelinaceae	10. Urticaceae	10. Urticaceae

It is evident from the above comparison that in dominance families like Fabaceae, Poaceae and Lamiaceae show similarity to that of Gamble's flora, while most of the families slightly vary in position of dominance with that of Hooker's flora. On the contrary only one family, viz., Lamiaceae resembles that of both the floras in order of dominance.

PLAN OF PRESENTATION

The classification of Bentham & Hooker (1862 '83) has been followed since the Madras Herbarium is arranged according to this system. However, in the circumscription of certain families that have been recently split up, Hutchinson's concept (1959) has been adopted. An artificial key to the families has been provided. In the enumeration, key to the genera under each family and key to the species under each genus has been given. The genera under each family and species under each genus are arranged alphabetically. While for the generic names only authorities are given, for each species the correct name with the original citation according to the International Code of Botanical Nomenclature followed by the basionym, if any, and some of the synonyms commonly used in Indian floras, are provided along with references to the *Icones* of Wight/Beddome, *Flora of British India*, *Flora of the Presidency of Madras* and other monographs, revisions or otherwise related papers. Abbreviations of the periodicals are mainly according to *Botanico Periodicum* -