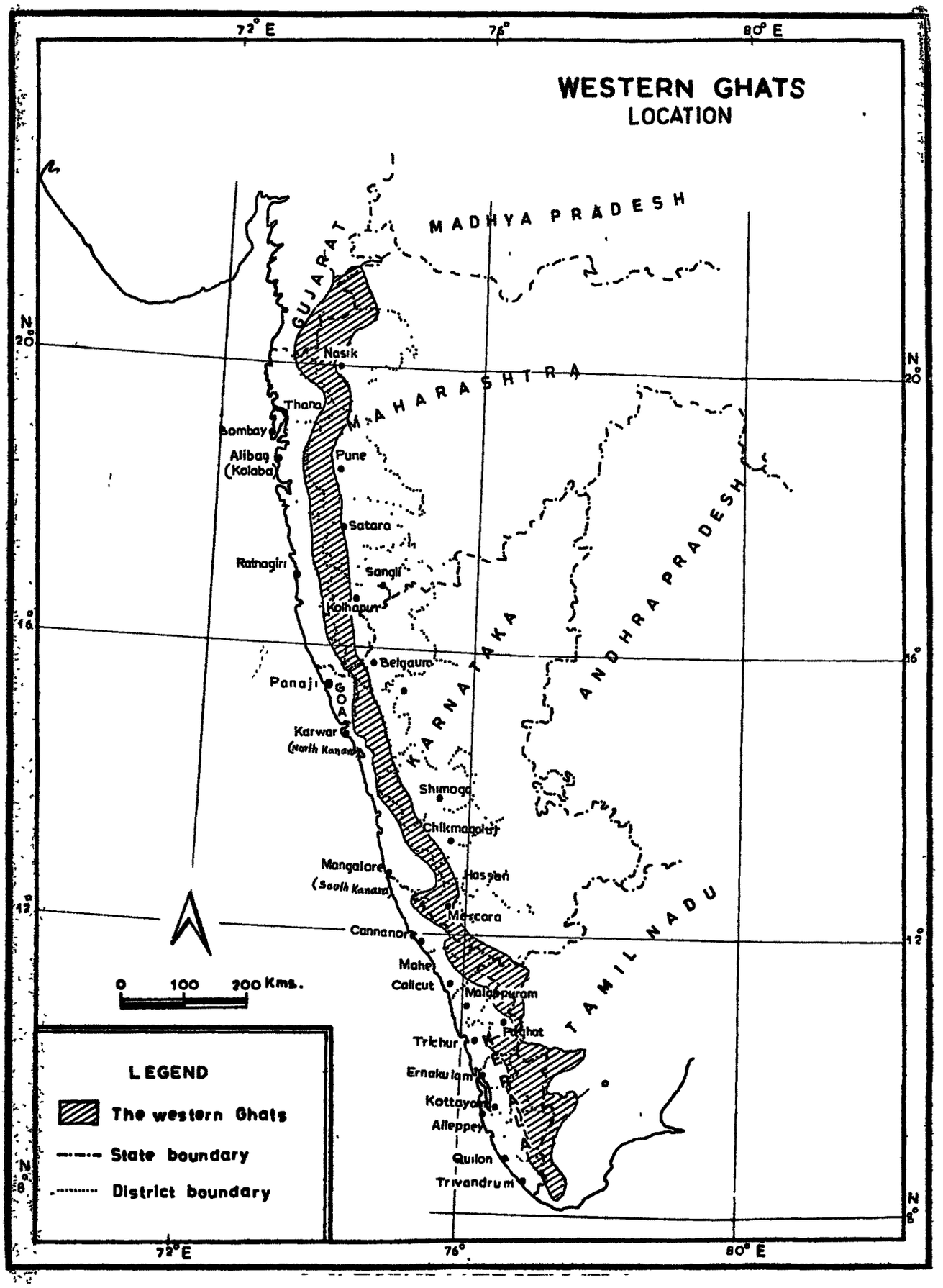
# II THE WESTERN GHATS


WESTERN GHATS
LOCATION
72° E
76°
80° E
N 20°
16°
12°
8°
GUJARAT
MADHYA PRADESH
MAHARASHTRA
KARNATAKA
ANDHRA PRADESH
TAMIL NADU
GOA
Nasik
Thana
Bombay
Alibag (Kolaba)
Pune
Satara
Ratnagiri
Sangli
Kolhapur
Belgaum
Panaji
Karwar (North Kanara)
Shimoga
Chikmagalur
Mangalore (South Kanara)
Hassan
Mercara
Cannanore
Mahe
Calicut
Malappuram
Palghat
Trichur
Ernakulam
Kottayam
Alleppey
Quilon
Trivandrum
0 100 200 Kms.
LEGEND
The western Ghats
State boundary
District boundary

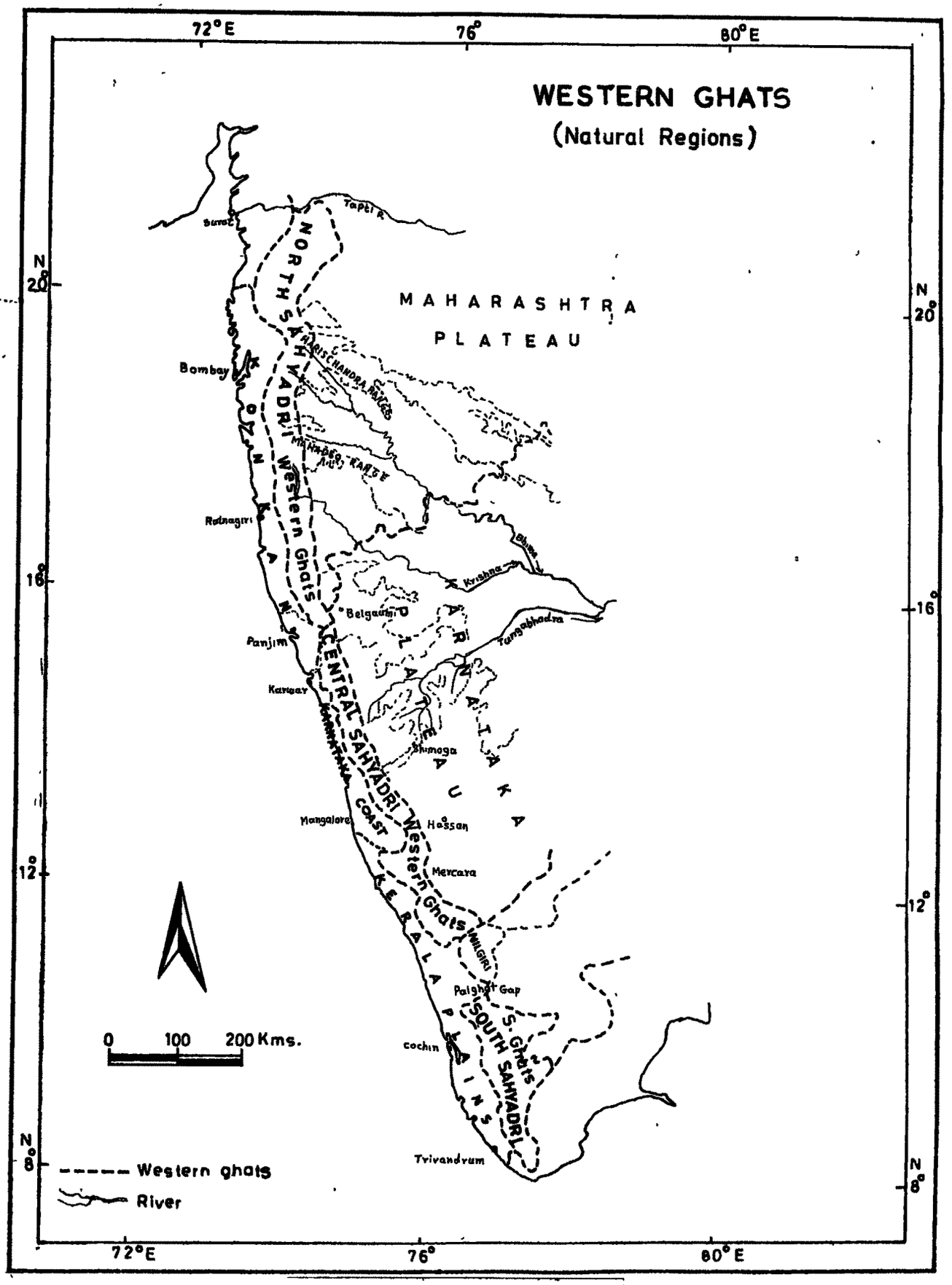
TEXT FIG. NO.1.

(i) DISTRIBUTION

India, broadly speaking, consists of three parts : (1) Peninsular India (2) Extra peninsular India - fitting on it like a cap and (3) Indo-Ganga plain - between the two. Each of three parts has its own geological and phytogeographical peculiarities. On both the sides of the triangular Peninsular India a series of mountain ridges lie almost parallel to sea coast - the Western Ghats and Eastern Ghats. Those on the Western side extend right from Kerala to Dangs in Gujarat.

The term 'Western Ghats' is applied to the whole line of mountains to the west of Peninsular India running almost parallel to Western coast of India (Text Fig.No.1).

The Western Ghats (the Sahyadri) lying between $8^{\circ}$ 15'N and $21^{\circ}$ 20'N latitude, with an average height of 1,200 m. runs for about 1600 km, along border of the Deccan, out of which 440 km of the Sahyadri or the Western Ghats in Maharashtra, from near the Tapti (Tapi) mouth in the Cape Comorin or Rameswaram, the southernmost point of India. It overlooks the Arabian Sea on the West and runs more or less parallel to the coast at a 'stone-throw' distance of 30-60 km from the sea. Viewed from the east, the range seems cut up into terraces but from the west coast it looks like a sheer wall. It appears like a ancient sea-clift, rising almost perpendicularly from the coastal lowlands upto 1000 m in


WESTERN GHATS
(Natural Regions)
72°E
76°
80°E
N 20°
16°
12°
N 8°
MAHARASHTRA
PLATEAU
Surat
Tapti R.
Bombay
Ratnagiri
Belgaum
Panjim
Karwar
Shimoga
Mangalore
Hassan
Mercara
Palghat Gap
Cochin
Trivandrum
Krishna
Tungabhadra
Bhima
NORTH SAHYADRI
Western Ghats
CENTRAL SAHYADRI
Western Ghats
COAST
KERALA PLAINS
S. Ghats
SOUTH SAHYADRI
KARNATAKA PLATEAU
0 100 200 Kms.
Western ghats
River

TEXT FIG. NO. 2.

places. It may also be a fault scarp and the part to the west of it may have either drifted away further westwards or subsided to form the sea-floor. This accounts for the fact that all important rivers of Peninsular India except the Narmada and Tapti flow eastwards into the Bay of Bengal, though they have their sources on the crest of the Sahyadri. The heights of the Sahyadri catch the full force of the moisture-laden monsoon winds; consequently heavy rains are precipitated on the western scarp face and coastal plain, and the island plateau bordering the Sahyadri on the east are deprived of rain.

Broadly the Sahyadri is divided into three sections namely : (1) The Northern Sahyadri i.e. from Dangs-Gujarat State to Goa territory; (2) The Central Sahyadri i.e. from Goa to Nilgiri Hills and (3) The South Sahyadri i.e. from South of Palghat gap to Cape Comorin (Text Fig.No.2).

The crest line runs in broad curves, forming two re-entrans at Trimbak and Tamhini, carved by the head waters of the Godavari and Bhima rivers respectively, and two easterly bulges marked by Harishchandragarh (1,424 M) and Mahabaleshwar peaks (1,438 M). Two other peaks rise higher, Kalsubai (1646 M) near Igatpuri and Salher (1567 M) 90 km to the north of Nasik. Talghat and Bhorghat are the important passes through which roads and railways run between the Deccan plateau and the Konkan plains.

For the next 640 km from the 16° parallel of latitude N to the Nilgiri mountain, the Sahyadri runs very close to the coast and at several places comes down to the sea-shore finally joining the Nilgiri mountain near Gudalur. Vavul Mala (2339 M) is the highest peak.

The Palghat Gap trending east-west marks a prominent break in the continuity of the Western Ghats range along the Western border of the Deccan plateau. It is about 24 km wide at its narrowest point and lies at an elevation of 144 m where a bordering ranges rise from 1500 m to 2000 M. It is mainly due to this gap that the densely populated coastal plains of Kerala can be linked with the rest of the Deccan by roads and railways and moisture-bearing clouds of the south-west monsoon can penetrate to some distance inland bringing rain to the parched plains of Mysore.

Beyond the Palghat Gap the Sahyadri again continues Southwards. It has different names in different parts, but is collectively known as the Southern Ghats. Anai Mudi the highest peak (2695 M) is a nodal point from which three ranges radiate in three different directions - the Anaimalai in the north, the Palni in the North-east, and the Cardamon hills or the Elamalai in the South. The Anaimalai descends into a series of terraces to about 1,000 M and the lower terraces are clothed with magnificent teak forests. Kodai-kanal, an important hill station is located in the Palani - hills. The Elamalai has a number of cardamon hills. It

faces on the east one of the most densely populated valley in South India, the Kambam valley. The Silent Valley is situated in the Southern part of the Western Ghats in Palghat District, Kerala State (11°5'33" N and 76°27'15" E). The Silent Valley reserve with an area of about 8952 hectars has still largely remained untrodden and uninhabited and perhaps, harbours one of the finest remnants of tropical evergreen forests in a near virgin condition in the country today.

The Nilgiri : The most picturesque and habitable mountain with temperate climate in the tropical part of India is the Nilgiri or Blue mountains. Its northest-southwest trend conforms to the trend of Eastern Ghats. The Nilgiri is the meeting ground of three mountain system of Peninsular India the Sahyadri joining of opposite Makurti Peak, the Southern Ghats across the Palghat Gap in the South, eastern Ghats in the north-eastern corner.

(ii) ECOLOGICAL OBSERVATION ON PTERIDOPHYTES OF WESTERN GHATS

Pteridophytes, although fairly common do not form a dominant vegetation anywhere in Western Ghats. Under favourable conditions occassionally, they become locally abandent conspicuous.

The whole pteridophytic flora has been placed under the following sections on account of their ecological preferences:

1. Ephemeral annuals : This is a large group sometimes forming a dominant part of the embanments and undergrowth vegetation in the monsoon. It includes Adiantum phillippense, Cheilanthes tenuifolia, various species of Athyrium, Aleuritopteris, Selagnella and Ophioglossum. Plants belonging to this group appear just after the beginning of the rainy season and disappear after the monsoon.

2. Heliophytic perrenials : (a) In this group Pteridium aquilinum is the only fern with widely creeping underground rhizome which reproduces vegetatively after coming out to the surface and thus covering large open area on the hill-slopes and forests borders.

(b) Dicranopteris linearis and Lycopodium cernuum are the thicket forming species which grow in the open hot sun. Their terrestrial running rhizomes root and branch continuously and form thickets. They are usually found on lime stone or calciferous soil-deposits usually in close association with each other.

(c) Besides the above mentioned vegetatively reproducing species, some scattered heliophytic species like Blechnum orientale, Pteris quadriaurita, P.biaurita, P.asperulata and Lygodium flexuosum are found, of which last one is a twining climber. All of these species prefer sloopy ground and yellow loamy soil for their growth.

3. Sciophytes : Angiopteris evecta and various species belonging to general Tectaria, Bolbitis and Egenolfia are found in dense shade of trees in humid places. The soil is usually black due to deposition of decayed forming the main source of humus.

4. Hygrophytes : This group includes Osmunda regalis, Lygodium microphyllum, Leptochilus decurrens var. lanceolata, Bolbitis presliana, Stenochlaena palustre and various species of cyclosorus. Out of these Lygodium microphyllum is a twining climber and Stenochlaena palustre is a scandent climber.

5. Halophytes : Acrostichum aureum is the only halophytic species which is found in brackish water. However it does not grow in sea-water.

6. Chasmophytes : No true obligatory lithophytes are found anywhere in the western Ghats. Some chasmophytic species which grow in cracks and crevices of stones are seen. Such species are Araiostegia pulchra, Actiniopteris dichotoma, Dryanaria quercifolia, Microsorium membranaceum, Microsorium membranaceum, Microsorium puncutatum etc. But out of these Actiniopteris dichotoma is the only obligatory chasmophytes. The rest occur as epiphytes on tree also.

7. Psammophytes : Ampelopteris prolifera is the only species found exclusively on sandy river banks very rarely. Diplazium esculentum, Nephrolepis exaltata and various species of Cyclosorus are seen growing as facultative psammophytes.

8. Tropophytes : Cyathea gigantea, Cyalhea latebrosa, Microlepia speluncae prefer sciophytic conditions but they can survive and also do well in open sunny places. Similarly Ceratopteris thalictroides and various species of Marsilea grow well under water but they can survive when water begins to dry. These plants withstand the changed atmospheric conditions with a few morphological adaptations.

9. Epiphytes : Epiphytes could be classed here under following three different groups.

(a) Bracket forming : Drynaria quercifalia is very common bracket forming epiphyte found all over Ratnagiri district, Sindhudurg district, Goa and N.Kanara. This species is generally seen growing epiphytic on Artocarpus integrifolius and Mangifera indica. But rarely it is found growing on other trees and even sometime on rocks.

(b) Hemiepiphytes : Leptschilus decurrens var. axillaris is the only species which in initial stages grows on trees.

(c) Proto-epiphytes : Araiosteqia pulchra, Leucosteqia immersa, Microsorium membranaceum are generally found epiphytic on the bases of tall trees at upto 0.5 meter from the ground. Asplenium crinicaule, A.laciniatum, A.planicaule, Pyrrosia adnascene, Pleopeltis nuda, Microsonium membranaceum and species of Trichomanes and Hymenophyllum are found on the middle height upto 5 meters. Lycopodium hamiltonii, Pyrrosia adnascens and Microsorium membranaceum are found on trunks and on the nranches of tall trees. Psilotum triquetrum is found on roots of Coconut and Arachea species.

10. Hydrophytes : Hydrophytic pteridophytes could be segregated into following four groups depending on their water relations :

a. Submerged : Ceratopteris thalictroides, Equisetum debile, Isoetes coromandeliana, Marsilea minuta and M.major are found partly submerged in water very often during the rainy season. They remain completely submerged but usually their leafy half remains outside the water level. Very commonly Ceratopteris thalictroides is seen uprooted from the base and large masses of this fern found floating on the surface of the water.

b. Floating : Azolla pinnata is the species found floating on the surface of thew water in ponds near Bombay. This is introduced species. It is not generally found in wild states beyond the limits of greater Bombay, Ratnagiri, Sindhudurg and Kolhapur districts.

(iii) GEOLOGY

The Western Ghats (The Sahyadri) is composed of at least two different types of rocks of varying hardness on the basis of which the range can be divided into two sections. The northern 640 km of the Sahyadri is built of horizontal sheet of lava, 6 to 24 meters thick, separated occassionally by thin partings of lake or river sediments.

For the next 640 km from the $16^{\circ}$ parallel of latitude N to Nilgiri mountain the granitoid gneiss takes place of basalt and the countryside has a different aspects.

The Deccan Traps : The end of the cretaceous and the beginning of Eocene was a period of intense volcanic activity in the Deccan of a type that has no parallel in the volcanic phenomena of the modern world. Several hundred thousand square kilometers of Maharashtra was flooded by quiet outflows of lava from tissures in the earth surface which was eventually converted into a volcanic plateau over 1800 metres in height and more than 1,000,000 sq.km. in area. The denudation of ages has carved out this plateau into numerous isolated flat topped hill-masses which are today such a characteristic feature of the picturesque landscapes of the Western Ghats. In the dissected sides of these peculiar Ghat shaped hills are seen today the piles of interbedded lava flows, 6 to 24 meters thick in horizontal attitudes, separated occassionally, by thin partings of lake or river sediments.

The smooth Malbar coastline from Cambay to Comorin is the result of faulting; the escarpments of the Western Ghats, parallel with the coast, are ascribed to this scarp-fault of late pliocene time.

(iv) GENERAL ASPECTS OF THE VEGETATION

As peaks are elevated to the maximum extent on the Western side rightly designated as Sahyadris. They get very high rainfall 135 to 625 cm or even more but the coastal plains get only 125 - 250 cms., as the Sahyadri heights blocks the monsoon clouds.

Monsoon being a periodic phenomenon, the forests are not uniformly developed or well wooded. They are discontinuous.

Taking into consideration the climate, soil and rainfall the important factors responsible for development of different forests types. Their development is believed to be as follows :

Evergreen forests - Semievergreen forests - Deciduous forests - Scrubs - open grasslands or pastures, locally called Kurans.

But according to Meher Homji (1977) development of the vegetation of the evergreen or semievergreen forests is also from the deciduous forests. The present day vegetation of the Western Ghats - the Sahyadri may be summarised as comparing evergreen or semievergreen forests, deciduous forests and scrub followed by many open grass lands.

At hilly uplands which receive 75 - 125" rain per annum the weather is cooler than surrounding plateau. They receive most of the rain from first week of June to the end of September almost incressantly. During rest of the year they get heated up and unloosen the rock and soil which are washed down into the valleys. The fine silt and lateritic soil from hill tops get deposited and excellent forests are found in these valleys, where there is better soil cover.

For the luxurient growth of ferns and fern allies there is necessity of moist and shady places; where normally they can grow gregariously. Therefore, the thick forests canopies are normally rich in pteridophytes.

Types of forests :

1) The Evergreen forests : These are mostly restricted to the higher ridges of Western Ghats and occur around Mahabaleshwar, Matheran, Amboli, Bhimashankar, Castel Rock, Anmode, parts of Poona district i.e. near Lonavala and Goa and Silent Valley.

Rainfall : Restricted to southwest monsoon from June to October and varies from 3600 to 6000 mm.

Climate : Generally temperate.

Soil : The basaltic traps capped by laterite which give rise to red soils.

2) Semi-evergreen type :

These occur mostly on the Western Ghats between evergreen and moist deciduous forests at altitudes varying from 450 to 1050 m. They occur in Ajra, and Chandgarh forests of Kolhapur, Koyana, parts of Satara, Ratnagiri, Poona and Savantwadi.

Rainfall : Restricted to Southwest monsoon and varies from 2000 to 2500 mm.

Climate : Warmer than in the evergreen type.

3) The Moist deciduous forests :

They are found in Kolaba, Sindhudurg, Ratnagiri, Thana, Nasik.

Rainfall : 1500 to 2000 mm mostly restricted to Southwest monsoon.

Climate : Warm 25°C - 43°C.

Soils : Sandy loam to deep loam

4) Tropical, Dry deciduous type :

This type occur in part of Nasik, Thana, Poona, Satara and Sangli.

Rainfall : Varies from 850 - 1300 mm.

Climate : Hot.

5) Southern Tropical - Thorn forest :

This type is met within drier areas with low rainfall e.g. Poona, Satara districts.

The Silent Valley has luxuriant evergreen forests and is botanically, ecologically and phytogeographically very important and interesting.

According to Mahabale (1979) the small temperate species are also there in places like Panchgani, Mahabaleshwar, Radhanagari, Castle Rock, in North Kanara, Goa, Phonda, Amboli, Muliyangiri in Bababundhan hills etc.

The evergreen forests lost their major broad-leaved, tall species and turn into semievergreen, but the question is how these temperate elements have come to be here ? Were there temperate forests here in the distant past ? At present we do not find temperate forests in Maharashtra and in the regions adjoining the Western Ghats.

(v) THE IMPORTANT LOCALITIES IDEAL FOR FERN COLLECTION :

(1) Gujarat State : i) Surat district : Dangs-Girna Hills.

(2) Maharashtra State :

i) Nasik district : Trimbak-Anganeri range; Bhaskargad (1086 M) and Igatpuri.

ii) Thana district : There are numerous peaks in the main Sahyadrian Range; Prominent among them are Valvihir, Kalsubai over the shoulder of Tigers terrace known as Vaghacha Patrar and Harishchandragad.

iii) Bombay : Victoria Garden, Borivali, Andheri, Kanheri caves and many other gardens.

iv) Raigad district : Matheran Hill Station.

v) Poona district : Lonavala, Khandala, Purandar, Sinhagad or Kondhana fort, Parvati hills, Bhimashankara etc.

vi) Ratnagiri district : The Hatlot pass, Ambavli Ghat, Kumbharli, Tivra, Mala, South Tivra, Kundi, Amba, Vishalgad, Anaskura, Bavda, Phonda etc.

vii) Sindhudurga district : Amboli, Savantwadi, Vengurla, Redi, Aronda, Malvan.

viii) Satara district : Kas, Bhushangad, Karad, Mahabaleshwar, Wai, Panchgani etc.

ix) Sangli district : Shirala.

x) Kolhapur district : Kolhapur, Panhala, Radhanagari, Ajra, Bavda, Chandgad, Ramling, Dajipur etc.

(3) Goa Territory : Panjim, Cankon, Mapusa, Thivim.

(4) Karnataka State : Belgaum, Dandeli, Londha, Dudsagar, N.Kanara, S.Kanara, Castle-Rock, Anmode etc.

(5) Kerala State : Silent Valley, Nilgiri hills, Trivendrum, Rameswaram etc.