II. STUDY AREA

Kerala state lies along south west corner of Peninsular India between $8^\circ 18'$ and $12^\circ 48'$ N latitude and $74^\circ 52'$ and $77^\circ 22'$ E longitude, bounded with Lakshadweep Island in the west, Tamil Nadu in the south and east and Karnataka in the north. The state has an area of 38,863 km$^2$ which is about 1.18% of the total area of the country and administratively divided in to 14 districts. Due to the presence of Western Ghats along the eastern side and Arabian Sea along the western side, the physiography of the state is highly diversified with a complex topography having mountains, valleys, ridges and scarps, altitude ranges from sea level to 2695 m above msl. Depending upon the altitude, the land is divided into high ranges (above 750 m msl), high land (between 75-750 m msl), midland (between 7.5-75 m msl) and low land (below 7.5 m msl). Because of its vivid climate and topography, the Western Ghats portion of Kerala is rich in its floristic diversity in harboring about 500 species of flowering plants, which is $\frac{1}{4}$ of the plant wealth of the country is facing enormous threat from the anthropological activities such as over exploitation, lack of scientific managements for the protection, etc. Though the several measures such converting the forests in to sanctuaries, parks, etc. has helped to conserve the plants in situ but our knowledge with their association with the other microbes is very meager. Hence, this is an attempt to understand the association of mycorrhizal fungi with the five categorized medicinal plants: Endemic and vularable (*Celastrus paniculatus* Willd., *Heracleum condolleanum* (Wight & Arn.) Gamble and *Nothapodytes nimmoniana* (Graham) Mabb.), Endangered (*Holostemma annulare* (Roxb.) Schumann), and Critically endangered {(*Decalepis arayalpathra* (Joseph & V. Chandras.) Venter)} plants occurring in different types forests (Evergreen, Deciduous and grassland and rocky areas) at different altitudes (100 to 1800 m).

The selected plants are distributed in interestingly diversified forest areas of Kerala, namely, Wayanad {(*Celastrus paniculatus* Willd., *Nothapodytes nimmoniana* (Graham) Mabb.)}, high ranges of Idukki {(*Celastrus paniculatus* Willd., *Heracleum condolleanum* (Wight & Arn.) Gamble and *Nothapodytes nimmoniana* (Graham) Mabb.)} and adjoining parts of Kottayam district namely Vagamon hills {(*Celastrus paniculatus* Willd., *Heracleum condolleanum* (Wight & Arn.) Gamble and *Nothapodytes nimmoniana* (Graham) Mabb.}) and Thiruvananthapuram {(*Celastrus paniculatus* Willd., *Holostemma annulare* (Roxb.) Schumann and *Decalepis
Decalepis arayalpathra (Joseph & V. Chandras.) Venter. It is the species having narrow and restricted distribution. The plant is confined to rocky slopes above 700 m, was collected from Bonacaud hills of Thiruvananthapuram, and Holostemma annulare (Roxb.) Schumann, the plants is mainly distributed in deciduous forests including moist deciduous forests, southern dry mixed deciduous forests etc. and also in open grass lands of midlands and in high lands. This study concentrates four different places of Thiruvananthapuram district of Kerala.

Heracleum condolleanum (Wight & Arn.) Gamble, showed high degree of endemism. The plant is mainly distributed in mountain wet grass lands, particularly above 1100 msl. The major habitats are Idukki, Kottayam and some high ranges of Silent Valley National Park and in Agasthyavanam Biological Park. While the major habitat of Heracleum candelleanum is restricted to the high ranges of Idukki (Munnar, Devikulam andMattupetty) and in the Vagamon hills of Kottayam district. The present study focuses only those locations of Idukki, and Kottayam districts of Kerala state, and Nothopodytes nimmoniana (Graham) Mabberly. This small tree species found in almost all type of forest ecosystems including Deciduous, evergreen, semi-evergreen etc. the plant is most commonly found in an altitude of 500-1400 msl. The plant is forced to be vanished out from the ecosystems because of over exploration for various uses including firewood applications. The plant grown nearby human habitats are mainly destroyed because of its unpleasant flavor of its flowers, and un-awareness of its medicinal importance is another course of distraction. Samples were collected from Wayanad (Padinharathara), Idukki (Munnar), Kottayam (Vagamon), and Thiruvananthapuram (Ponmudi) districts of Kerala state.

Celastrus paniculatus Willd, the woody climber plant species are found mainly in evergreen forests, semi-evergreen forests and moist deciduous forests throughout the Kerala. This plant is found in an altitude of 300- 1300 msl. Which is also found in many degraded or disturbed ecosystems like cut walls of the road side in high ranges of Kerala that is Idukki, Wayanad, Thiruvananthapuram, Pathanamthitta, Kottayam, Kozhikode and Palakkad districts. Since, it is vulnerable in status. However, locations from Idukki (Munnar), Wayanad (Padinharathara), Thiruvananthapuram (Ponmudi) and Kottayam (Vagamon)
districts were selected for the study. The study locations were selected mainly on the distribution of plant communities growing in natural ecosystems in different parts of the state.

**Soil and Climate**

There is a variety of different soils including red, ferruginous, sandy, black, peat, laterite and loamy soil in many parts of the State. The soil of South Western Peninsula of India-Kerala is lateritic and very permeable like the soil of desert or arid regions. It is devoid of humus and is unable to retain much water. However, alluvial soil is usually found along the banks of the main rivers and broadly in the lower basins of the Pampa and Periyar rivers. Besides these regions, alluvial deposits are also found in the paddy fields of Kerala. Laterite soil is found in the midland and high land regions, red soil in the Southern-most part of Kerala. In general, Kerala state has a humid climate except in the southern most pockets and in the eastern part of Palakkad region which possess a moist sub-humid climate.

**Temperature**

The mean annual temperature varies from 25.4° C-31° C in the central part of Kerala while the temperature drops to 15° C in the hills. March- May are summer months and the temperature rises to 40° C in the central plains. The temperature comes down during July- August due to high rainfall during south west monsoon. Relative humidity varies between 85-95% during June and lowers to 70% in summer months.

**Rainfall**

The state receives both south west and north east monsoon. The mean annual rainfall is 2693 mm. The Southern parts of Kerala experiences comparatively higher rate of south west and north east monsoon while the northern districts of Kannur and Kasargod receives very little rain from the north east monsoon. Since western parts of the state are facing the Arabian Sea, south west monsoon is more active and account for 60% of annual rainfall on an average.
Vegetation

Kerala state is diversified in its physical features and agro-ecological conditions. The land is panoramic with evergreen forest, picturesque landscape and backwaters. The varied topographical features, high rainfall and geologic conditions have favored the formation of different ecosystems from shola forest on the mountain valleys to the mangrove forest along the sea coast. The most standing features of the state are the formation of tropical rain forests, in the windward side of the Southern Western Ghats which is lying parallel to the west coast. A small extent of area of the state is along the rain shadow region of the Western Ghats where the vegetation is dominated by dry deciduous forest and scrub jungle. Forest in Kerala presently covers 28.63% (11125.5km²) of the total geographical area. Major forest types recognized in the state are wet evergreen, semi-evergreen, moist deciduous, dry deciduous, sholas and grasslands (Chandrasekharan, 1962; Mehr-Homji, 1967, 1987-1988; Champion & Seth, 1968; Pascal, 1988). There are 41 west flowing and 3 east flowing rivers cut across the state with their innumerable tributaries and branches. Twelve Wildlife Sanctuaries, two National Parks and two Biosphere Reserves, two tiger reserves, bring 20.9% of forest in Kerala under the protected area.