I INTRODUCTION

There are about 2,65,000 species of flowering plants occurring in the world of which the tropical flora consists of about 1,80,000 species of these, about 35,000 are Asian (Raven 1988). The flora of India comprises about 45,000 species from unicellular cyanobacteria to the flowering plants representing 11% of the world’s total plant species. The flowering plants alone number about 15,000 species which represent 6% of the world’s total (Nayar 1987). However, Ayensu (1986) and Karthikeyan et al. (1989) have estimated that there are about 17,000 to 18,000 flowering plants in India. The wet evergreen forests of India occupy 51,249 sq. km area. Although this represents only 1.5% of India’s land surface (Nayar 1987); it holds about 7,000 species which is about 40% of Indian flora.

The greatest concentration of floristic and functional diversity occurs in tropical and subtropical regions (Tomlinson and Raven 1977); but they are also the most poorly collected regions (Prance 1977). The destruction of the vegetation in tropics is alarmingly faster than the biological inventorisation (Raven 1976). The tropical flora occurs mostly within the territory of developing countries where technical advance is vital and urgent to alleviate poverty. Such advances traditionally include the destruction of large areas of natural vegetation for replacement by farms, timber extraction, industrialisation and urbanisation (Prance 1977). This ultimately leads to the disappearance of several taxa before they could be known to the world.

Tomlinson and Raven (1977) has pleaded for an intense study of the vegetation and ecosystems of the tropics which is urgently needed. Raven (1986) estimates that about 60,000 species of higher plants are likely to become extinct by the year 2050. Soule (1990) believes that 25% of the tropical plant species will disappear by the year 2020, i.e., a loss of about 34,000 species of plants, 12.5% of the world’s flora.

Steenis (1977) made an important plea to the tropical collectors to improve their field data. Prance (1977) has suggested that researchers must concentrate on a smaller area over an extended period of time; this type of inventory would yield data of great value for several disciplines including ecology and conservation biology. Raven (1988) is of the opinion that florulas of local areas would yield more complete information on the overall plant wealth of that region. Also, intense regional studies would yield more information on ecological and morphological variations that could be obtained from a study based on herbaria (Ashton, 1988). Florulas are shown to be more useful than larger floras (Prance & Campbell, 1988).

Hence, it is substantiated that these kind of many mini-floras will be of great significance for the better understanding of the Indian flora. The present study is a detailed investigation of dicotyledonous plants based on intense field study of a region of India rich in plant wealth namely the Madurai district.

II AREA OF STUDY

1. HISTORY OF MADURAI

The ancient history of Madurai is linked with the history of Pandyas, one of the three Tamil rulers. The Madurai was known as Kapatapuram, during the early sangam period, about 2000 B.C. The classical writers of Greece and Rome were acquainted with the Pandyan kingdom. Megasthenes (302 A.D.) speaks of a country called Pandya. Strato (20 A.D.) records about an embassy sent by the Pandyan King to the emperor Augustus. Ptolemy (140 A.D.) writes about 'Modoura, the kingdom of Pandians'. Literary works of the Tamil Sangams and several stone inscriptions give a detailed account of the history of Pandya Kings and of Madurai.

Sangam age was followed by nearly three centuries (300-600 A.D.) of occupation by Kalabarars who were followers of Buddhism. The Hindu Pandya Kings regained power at the end of the sixth century. It was under Pandya rule from 590 to 920 AD. From 10 to 13th century Madurai remained as part of Chola empire. Sundara Pandiar, in order to settle the internal rift, invited the aid of Ala-Ud Din Khilejii, the Sultan of Delhi, thus paving the way for entry of Mohals in India. The Muslim rule in Madurai lasted from 1334 to 1378. Later Nayaka regime was established by Vijayanagar rulers. Krishna Deva Raya, the famous Nayaka King, came to Madurai about 1520-1525. Modern Madurai was constructed by the Governor Viswanatha, an outstanding warrior and statesman. The golden period of Madurai was during the Thirumalai Nayaka regime.
During the Nayaka regime, there was gradual encroachment by the British, the Portuguese and the Dutch. After Nayaka period, Madurai was drawn into the politics of Nawabs and Europeans. In 1795, Madurai district came into the hands of British. Since then Madurai remained under British administration till the country attained independence in 1947. In 1974, Madurai attained the status of Corporation, next to Madras. In 1985, Madurai district was bifurcated. The new Dindigul-Anna district includes Dindigul, Kodaikanal, Palani, Nilakottai and Nattam taluks. Madurai district has nine taluks namely, Andipatti, Madurai North, Madurai South, Melur, Periyakulum, Thirumangalam, Usilampatti, Uthamapalayam and Vadipatti.

2. LOCATION AND BOUNDARIES

Madurai district lies between 9° 31’ and 13° 35’ north latitude and 77° 10’ and 78° 30’ east longitude. It is bounded on the north by Dindigul-Anna and Tiruchirappalli districts, on the east by Pasumpon Devar Thirumagan district, on the south by Kamarajar district and on the west by Kerala State (MAP 1). This district has neither coast line nor deserts.

3. AREA AND POPULATION

The total area of Madurai district is 6901.5 sq.km (6608.8 sq.km rural and 292.7 sq.km urban) which is the ninth largest district in the State. The total forest area in the district is 1724.33 ha which constitutes 7.86% and ranks fifth in the total forest area of the State. The total population of the district is 2,970,224 of which 1,664,889 are from rural and 1,305,335 are from urban areas. The total tribal population in 1981 census is 413.

4. GEOLOGY AND SOIL

More than 85% of the soil in the district is classified as red soil (red ferruginous). The black soil (the regar) predominates only in Thirumangalam and Periyakulum taluks. In Cumbum Valley the soil is deep sandy loam of reddish hue. The red soils are of two types viz., the red loams and red sands and the black soils are of three types viz., the black clays, the black loams, and the black sands. The soils of foothills are generally shallow, stony and dry. According to Soil Testing Laboratory, Madurai, seven major soil series have been identified. They are Irugur, Palaviduthi, Pilamedu, Vylogam, Somaynar, Palathurai and Aniyur series. Irugur series occupy the major areas in the district. All these fall under different soil orders viz., Entisol, Alfisol, Vertisol and Inceptisol. The parent materials of these soil series are Alluvium, Colluvium, Gneiss, Gneiss with calcium carbonate and weathered gneiss with calcium carbonate. The hills of Madurai district consist of gneissic rocks. Granular quartz is predominant in Alagar hills. In Nagamalai hills the gneisses are mostly granitoid. In the plains it is chiefly of black cotton soil with frequent occurrence of limestone. The lower granitoid gneiss and black soil are common in Thirumangalam taluk. The Vaigai river beds are with alluvium soil. In Varushanadu hills there are horn-blende shists and granulites. The Cardamom hills are with laterite, red, mixed red, yellow and grey and clayey black soils.

The gneissic rocks in the district are divided into six groups: the upper granular quartz rock, the upper granitoid gneiss, the middle granular quartz rock, the middle granitoid gneiss, the lower granular quartz rock and the lower granitoid gneiss.

5. CLIMATE AND RAINFALL

The climate of the district on the whole is hot and dry. The Pachakumatchi hills, Vellimalai and Bodi Mettu have, however, a climate with low temperature almost throughout the year and fairly heavy rainfall during both the southwest and northeast monsoons. During November-February there is heavy dew in these areas, the nights become chilly, the mornings and evenings are often foggy, but in day time the temperature shoots upto 30°C. After January the days get hotter and the dew becomes less with occasional rains in February and March. In April and May the heat is intense which continues until August. In October and November the northeast monsoon sets in and during these months the entire district receives heavy rainfall.

The average maximum temperature of the district excluding Pachakumatchi hills, Bodi Mettu and Vellimalai from 1983 to 1992 was 36°C and the minimum is 23°C. The average maximum temperature for a month is during May, which shoots upto 38°C and the minimum is during December when it is as low as 25°C (TABLE 1). In the higher altitudes such as Pachakumatchi hills, Bodi Mettu and Vellimalai the maximum temperature is 32°C and the
TABLE 1

COMPARISON OF YEARLY TEMPERATURE & RELATIVE HUMIDITY (1983-1992)

COMPARISON OF MONTHLY TEMPERATURE & RELATIVE HUMIDITY
TABLE 2
AVERAGE YEARLY RAINFALL DATA
(1983 - 1992)

AVERAGE MONTHLY RAINFALL DATA
minimum is $10^\circ$ C. In these areas the difference between the day and night temperature is generally high. In general the humidity is as high as 76%. Humidity reaches a maximum of 80% during the monsoon season and a minimum of 64% during June (TABLE 1).

The district receives an average rainfall of 799 mm per year (TABLE 2). The maximum rainfall is during the northeast monsoon seasons. However, the southwest monsoon which sets in the month of May also brings a considerable amount of rain. Compared to the plains the rainfall in the hilly regions is higher.

6. RIVERS

The important and major rivers are Vaigai and Suruliyaru (MAP 1). Vaigai originates from Vellimalai and drains in Varusshanadu Valley. It has rivulets as tributaries viz., Sitaru from Varusshanadu Valley; Upper Manalaru, Manalaru and Iravangalaru from Pachakumatchi hills eastern slopes; Moongilaru from Saduragiri hills; Mullaiyaru from Cumbum Valley; Kalikka Vaiyaru from south Gudalur; Kottakkudiyaru, Chinnaru, Koovilangaru, Muthukombiayaru from Cardamom hills. It is interrupted by the Vaigai dam near north of Andipatti. Suruliyaru originates in Pachakumatchi hills and flows towards the western slopes of Cumbum Valley and joins with Vaigai. Apart from this, river Periyar which originates from Kannimalai from the high ranges of Travancore bordering Madurai district, also joins with the river Vaigai near Cumbum Valley. The river Vaigai after traversing Pasumpon Devar Thirumagan and Ramanathapuram districts, discharges into Bay of Bengal.

7. HILLS

This district has several hill ranges and off shoots from the Western Ghats which separate this region from Kerala State. More important hill ranges are the Pachakumatchi hills, Varusshanadu hills, Vellimalai, Cardamom hills, Combai hills, Bodhi hills and Periyakulam hills, all of which are direct off shoot of Western Ghats. Isolated patches such as Usilampatti hills, Andipatti hills and Saduragiri hills run towards the eastern side of the Pachakumatchi hills.

Pachakumatchi range (Pacha = Green; Kumatchi = pyramidal hills) earlier known as High Wavy's Mountain is a complex of several hill estates such as, Kardana, Megamalai, High Wavy's, Manalar, Upper Manalar, Iravangalar Mettu, Maharajamettu and Venniyar. It is situated at the southwest part of the district and lies between Varusshanadu Valley and Cumbum Valley. It has a total area of 10,000 acres in which around 2000 acres are tea plantations established in 1947 with several pockets of virgin evergreen forests. The altitude ranges from 600 m to 2000 m. The highest peak in Pachakumatchi hills is Brooke Peak. Towards the southeast is the Vellimalai with thick forests and cardamom and coffee plantations. On the eastern side of these hills are Varusshanadu hills in continuation of Andipatti hills, Kudiramalai and Saduragiri hills. The western side of the Pachakumatchi hills are the Cardamom hills which run almost parallel to the Cumbum Valley. The Cumbum Valley is horse-shoe shaped, surrounded by hills and the river Periyar flows in. On the southwest lies Thekkadi hills of Kerala State, bordering Madurai district which are a continuation of Southern Western Ghats. The continuation of Palani hills in the west is the Bodhi hills which separate Munar of Kerala State from Tamiul Nadu. The central portion of the district is flanked with several isolated hills such as Usilampatti range and Andipatti hills. On the northeast side there are Alagar hills and Karandhamalai. The city of Madurai is surrounded by several hills. On the eastern side there are Nagamalai, Thirupparangundram hilllock and Pasumpon. On the northern side there are Yanai malai and many isolated hilllocks. On the northern side there are Puramalai, Karungalakudi hills, etc. All these hills harbour a rich and varied vegetation ranging from scrub to sholas.

8. IRRIGATION AND POWER

Vaigai Project: The catchment area of Vaigai dam is 9.4 sq.km, length 11,675 feet, depth of 21.64 m and the water holding capacity is 68,000 cubic feet. The major taluks benefited by this dam are Thirumangalam, Madurai South and Melur. About 16,400 acres are irrigated.

Periyar Project: Under this scheme at 3000 feet MSL on the Western Ghats near Amaravathisagaram an artificial lake is formed. This lake impounded by the dam has a maximum depth of 46.33 m. Water flows into Vairavan stream which feeds Suruliyaru which in turn reinforces the river Vaigai to irrigate more areas. The total area irrigated under the Periyar Scheme is about 146,000 acres in Madurai district.