MATERIALS AND METHODS

Chapter - III

MATERIALS

The source of materials for this floristic research was the extensive and intensive field collections of specimens made from the study area during the period from January 1999 to 2002 June. Several field trips were undertaken to the various parts of the district covering all seasons. Collections were repeated till full data on flowering and fruiting were gathered. Present investigation includes 793 species of 416 genera belonging to 102 families from the study area. All the specimens are housed at Xavier's College Herbarium (XCH), St. Xavier's College, Palayamkottai. Apart from the herbarium specimens, supplementary collections like picked materials, wood, bark, photographs etc. were made.

METHODS

Collection

During the field studies, complete specimens with five duplicates were collected. 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 leaves / flowers, colour of the flowers/fruits, pubescence and secretions on the vegetative and reproductive parts and habit/habitat association were also noted. In case of small herbs, the whole plants with roots or under ground parts were collected. The available flowers and fruits were picked and preserved in kew spirit.

Photographs

Photographs were taken with pentax-K 1000 camera. Photographs illustrating important localities and species were taken during the field visits and have been presented as colour plates.
Field notes

A very important part of the plant collection is the record of field notes. The data such as date of collection, names and (family and species), uses, locality, habit frequency, habitat distribution, nature of stem, leaf, texture and colour of the flowers, fruits and other related notes were recorded in the field note book (22 x 28.5 cm).

Processing

The large specimens were trimmed to the size of about 20 cm length and the excess leaves and flowers were removed without altering the arrangement and position of leaves, flowers and fruits.

Poisoning

The collected specimens were poisoned immediately after collection. This was done by dipping the whole plant in the denatured spirit.

Pressing and drying of specimens

Pressing is the process of placing specimens between the absorbents under moderate pressure. The specimens were pressed after spreading out the leaves and flowers neatly. Some leaves were placed facing up and others facing down to show the characters on both surfaces. The main object of pressing is to flatten and dry the specimens. This was done by changing the blotters every day for 6-10 days depending on weather.

Mounting

The best specimen of every field number was mounted on mounting board (42 x 28 cm) using thread. A specimen pocket is provided for any broken part of the specimen. Field labels with important data from the field book were affixed at the bottom of right hand side.
Identification and Determination

For identification, the scientific method was followed. The characters of the plant were studied and checked with regional flora like Gamble, Flora of the Presidency of Madras (FPM), Matthew’s Flora of the Tamil Nadu Carnatic (FTC) and Hooker’s Flora of the British India (FBI) and the correct determinations were established. The identified materials were confirmed with regard to authentic type materials available in Madras Herbarium (MH), Botanical survey of India (Southern circle), India.

Taxonomical study

The authentically identified specimens were described in detail for selected families. The microscopic characters were observed and recorded; floral and the vegetative parts were noted using stereoscopic dissection microscope (STEL, HERTEL and REUSS, Germany). The indumentum and nature of branchlets and venation of leaves were examined with a hand lens and stereo microscope. The floral parts were studied using the fresh materials or dried materials. The latter one was boiled with distilled water for the minimum period and then examined as stated above. The delicate materials were directly soaked in water for the required period before analysing them.

Descriptions and Illustrations

Detailed descriptions prepared for the selected 5 families are given in the present study. The genus description has been prepared by extracting all the characters of the species. The same method has been followed for the family description. In enumeration part, short description (habit, leaf shape, inflorescence, flower colour and fruit) are given followed by the habitat phenology, field numbers of specimens collected and world distribution. Illustrations are given for selected species in the form of full page Indian ink drawing with appropriate legends.
Keys

The keys are strictly dichotomous. They are formed by the observed field characters, though books have been consulted. Keys are provided for the class, dicotyledons, monocotyledons, genera, species sub species, varieties of all families. The detailed description of five families is followed by enumeration of other angiospermic species with some essential data.

Nomenclature

The correct botanical name of the plant with its original citation followed by basionym and synonym taken from other floras is presented.

Vegetation of the area under study

The vegetation of Tirunelveli plains is varied depending upon the climate, altitude and edaphic factors. It can be broadly divided into the following categories:

Coastal vegetation

The coastal belt stretches from Uvari to Perumanal. This area has variable habitats (sand dunes, marshes, ponds, pools) for the growth of marshland, terrestrial, succulent and xerophytic flora.

The coastal area is rich in herbs such as Polycarpaea corymbosa (L.) Lam., Portulaca quadrifida L., Cassia nigricans Vahl, Aristolochia bracteolata Lam., Phyllanthus rotundifolius Klein ex Willd., Boerhavia diffusa L., Launea sarmentosa (Willd.) Sch.-Bip. ex Kuntze, Heliotropium ovalifolium Forssk., Enicostema axillare (Lam.) Raynal and Canscora heteroclita (L.) Gilg.

The grasses of this belt are Cyperus arenarius Retz, Spinifex littoreus (Burm.f.) Merr., Chloris barbata Sw., Dactyloctenium aegyptium (L.) Willd., Perotis indica (L.) Kuntze and Trachys muricata (L.) Pers. Bushy zones of coastal area of plains are Calotropis gigantea (L.) R. Br., Cissus quadrangularis L., Pergularia daemia (Forssk.) Chiov., Carissa spinarum L. Passiflora foetida L., Clerodendrum inerme (L.) Gaertn. and Coccinia grandis (L.) Voigt.
The common woody plants of coastal area have a height of 29 to 12 m and form complete evergreen canopy. The important coastal woody plants are *Thespesia populnea* (L.) Soland. ex Correa, *Hibiscus tiliaceus* L., *Lannea coramandelica* (Houtt.) Merr., *Erythroxylum monogynum* Roxb., *Carissa carandas* L., *Delonix elata* (L.) Gamble and *Mimusops elengi* L.

**Scrub jungles**

The interior plains occupy major part of the district and are the most densely populated area when natural vegetation has been replaced by plantations and paddy fields.

The natural vegetation of the plains bordering the coastal plains comes under southern tropical thorn forests of Champion and Seth (1968). These forests are called as ‘scrub jungles’. In these scattered forests trees seldom reach 10 m height and they are hard wooded and often armed with spines or prickles. Most plants including climbers manifest several xeromorphic features such as succulence, stunted growth and thorns. The common tress are: *Acacia nilotica* (L.) Willd. ex Del., *Acacia planifrons* Wight & Arn., *Acacia horrida* (L. f.) Willd., *Prosopis chilensis* (Molina) Stuntz, *Dichrostachys cinera* (L.) Wight & Arn., *Zizyphus mauritiana* Lam., *Zizyphus oenoplia* (L.) Mill., *Albizia amara* (Roxb.) Boivin, *Azadirachta indica* A. Juss. and *Lannea coramandelica* (Houtt.) Merr. Shrubs like *Cadapa fruiticosa* (L.) Druce, *Carissa carandas* L., *Pongamia pinnata* (L.) Pierre, *Vitex negundo* L., *Securinega leucopyrus* (Willd.) Muell.-Arg. and *Todalia asiatica* (L.) Lam. shows straggling habit.

Mollugo cerviana (L.) Ser. and Acacia planifrons Wight & Arn. with its umbrella shaped crown the ascending Borassus flabellifer L., Hedyotis puberula (G. Don) Arn. and the exotic Prosopis chilensis (Molina) Stuntz. are found intermixed and dominant. Barleria buxifolia L., Barleria prionitis L., Calotropis gigantea (L.) R. Br., Crotalaria juncea L., Cassia auriculata L., Dodonea viscosa (L.) Jacq., Euphorbia antiquorum L. and Euphorbia tirucalli L. are the common plants of shrub vegetation. Opuntia dillenii (Ker-Gawl.) Haw. has become naturalised in this district. This thorny scrub is degraded to a greater extent due to biotic interference.

Riparian vegetation

There are many plant species occurring along the courses of rivers and streams in the plains where alluvial soil is deposited. This riparian vegetation is maintained by the interaction of constant erosion and redeposition of the soil going on in the banks of rivers. It generally forms a very narrow belt along the banks and consists of evergreen or deciduous trees depending flow in the river throughout or part of the year. Arundo donax L., Pongamia pinnata (L.) Pierre., Saccharum spontaneum L., Terminalia arjuna (Roxb. ex DC.) Wight & Arn., Typha angustata Bory & Chaub., Fimbristylis complanata (Retz.) Link and Cymbopogon coloratus Stapf. are some of the representatives of riparian vegetation.

Aquatic and semi-aquatic vegetation

In lakes, ponds, puddles, marshy places etc. aquatic and semi aquatic vegetation is found with the following species: Aponogeton natans (L.) Engler & K. Krause., Hydrilla verticillata (L.f.) Royle, Pistia stratiotes L., Ceratophyllum demersum L., Eichornia crassipes (Mart.) Solms-Laib., Lemma perpusilla Torrey, Nelumbo nucifera Gaertn., Nymphaea pubescens Willd. and Ludwigia perennis L. Such species as Aeschynomene aspera L., Alternanthera pungens Kunth., Alternanthera sessilis (L.) R. Br. ex DC., Bacopa monnieri (L.) Pennell., Coldenia procumbens L., Eclipta prostrata (L.), Hygrophila auriculata (Schum.) Heyne, Panicum repens L., Nesaea lanceolata (Heyne ex C.B. Clarke) Koehne, Polygonum glabrum Willd. and Typha augustata Bory & Chaub. are found along the water margins.
Grasslands


PLANT GROUPS IN THE PLAINS

Herbaceous flora


Climbers

Shrubs

Some important shrubs are seen in wastelands and sides of the road. They are *Parkinsonia aculeata* L., *Abutilon crispum* (L.) Medicus, *Calotropis gigantea* (L.) R. Br., *Dodonea viscosa* L., *Flacourtia indica* Burm. f., *Flacourtia montana* Graham., *Lawsonia inermis* L. and *Catunaregam spinosa* (Thunb.) Tirvengadum.

Trees

The rich flora of Tirunelveli plains provide many useful trees. These trees are found in grasslands, wastelands, foot hills, gardens, banks of water sheds and also in avenues. Some of them, which yield various good timber of commerce are *Azadirachta indica* A. Juss., *Thespesia populnea* (L.) Soland. ex Correa., *Mangifera indica* L. and *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn. The other economically important trees found in the plains are *Ceiba pentandra* (L.) Gaertn., *Aegle marmelos* (L.) Correa, *Tamarindus indica* L. and *Manilkara zapota* L.P. Royne. The common avenue trees are *Cassia fistula* L., *Cassia siamea* Lam., *Polyalthia longifolia* (Sonner.) Thw., *Delonix elata* (L.) Gamble, *Samanea saman* (Jacq.) Merr. and *Albizia lebbeck* (L.) Willd. Trees which are found in foothills are *Butea monosperma* (Lam.) Taub., *Cippadessa baccifera* (Roth) Miq., *Phyllanthus emblica* L. and *Delonix regia* (Hook.) Raf. The wastelands is enriched by the following taxa: *Acacia nilotica*(L.) Willdl. ex Del., *Prosopis chilensis* (Molina) Stuntz, *Dichrostachys cinerea* (L.) Wight & Arn., *Cassia roxburghii* DC., *Pithececollobium dulce* (Roxb.) Benth. and *Lannea coramandelica* (Houtt.) Merr.

Established alien trees and weeds

Agricultural crops and plantations


Common medicinal plants are *Catharanthus roseus* (L) G. Don., *Gloriosa superba* L. and *Solanum torvum* Sw. and dye yielding plants *Indigofera tinctoria* L. and *Cassia senna* L. are planted in the plains. The common flowering plants such as *Jasminum sambac* (L.) Ait., *Jasminum grandiflorum* L., *Gomphrena globosa* L. and *Rosa damascena* Mill. are cultivated in wastelands.
Exotic plants

The flora of Tirunelveli plains has been enriched by the intrusive elements from other parts of Asia, Europe, Africa, etc. A number of species introduced from tropical America and Australia have been established and naturalized in the plains. Examples of the tropical African and Madagascarean elements found in this area are: *Acacia nilotica* (L.) Willd. ex Del., *Blepharis maderaspatensis* (L.) Heyne ex Roth., *Catharanthus roseus* (L.) G. Don., *Pedalium murex* L. and *Ricinus communis* L.


In a stable ecosystem all species of plants and animals form a close web and they are in a dynamic equilibrium. It is also accepted that man needs a reservoir of wild species in order to prevent genetic erosion of his cultivated crops. Extinction of species may be due to environmental factors, ecological substitutions, biological factors, pathological causes and anthropogenic interference like habitat destruction. There is no evidence of estimation of any plant species in the plains owing to paucity of information. Population explosion and its consequent pressure on plains including outright conversion of the areas in the plains into agricultural lands may be the loss of species, if any.

The area of study is under serious threat, though not much concern is expressed in any quarters. The need of the hour is to document the species so that suitable conservation methods can be adopted for specific cases. Otherwise, we may wake up when it is too late to remedy the situation.
**Previous exploration**

Systematic floristic exploration in India started with the arrival of Europeans. Major contributions towards the floristic studies in India were made by the Britishers. The area of the present study was not subjected to systematic exploration in the past. Ramaswami (1914) gave an account of the flora and vegetation of Tirunelveli district which is often quoted as an “epitome of Tamil Nadu”. There are references by earlier workers with regard to some other specimens like *Dalbergia coromandeliana* Prain., *Cassia nigricans* Vahl, *Andrographis serpyllifolia* (Rottl. ex Vahl) Wight, *Micrargeria wightii* Benth., *Striga gesnerioides* (Willd.) Vatke and *Lepidogathis pungens* Nees (Gamble, 1915 to 1927) collected from Tirunelveli and Palayamkottai.

The publications of Rangachari (1919) brought to light the rich floristic wealth of Tirunelveli District. Mudaliar and Sundararaj (1954) collected 855 species from the plains of Tirunelveli district including hills with statistical account. Rajasekhar Mudhaliar and Sakharam Rao (1955) revised the Handbook of some South Indian weeds.

During 1957-58, Subramaniam assisted by Nayar collected about 637 taxa of flowering plants and some ferns from Courtallum Reserve forests and adjacent plains but they are not published to date in any form. Shankaranarayanan (1960) published a brief account of vegetational types of Tirunelveli district (including Tuticorin district - at present). Arachi (1968) brought out a pictorial presentation of Indian Flora with special study on Courtallum in which he enumerated about 405 species of angiosperms. Later he published a book entitled ‘Weeds of Tamil Nadu’ in 1978 with special reference to Tirunelveli district. In 1986, K.K.N. Nair & Nayar published a book on the Flora of Courtallam (2 volumes) dealing with 745 spp of angiosperms belonging to 464 genera and 131 families. The work of Sharma *et al.* (1973) on Mahendragiri and surrounding areas gave additional information on the vegetation and flora of Kanniyakumari and Tirunelveli districts.

The present work includes all the angiosperms encountered in the study area along with the climatic data, distribution, availability of medicinal plants and weeds of the area. Original keys and descriptions have been provided for selected species and genera. The presentation includes the detailed treatment of selected families and a check-list of other families due to the page limitation imposed by the University.