CHAPTER ONE

INDOOR PLANTS AND ARCHITECTURE

1.1 INTRODUCTION

One of the most significant topics of the current discussion on energy conservation and environmental management systems in buildings are the renewed awareness of the natural environment and importance and the utilization of natures beneficial elements and their impact on building design. With the necessity to sustain the vital planetary systems for life on earth and our own well being, architecture is the central theme within an ecological context of our planning, interior design, landscape etc. Among the main beneficial elements of nature plants vegetation is one of the greatest. Plants are largely related to architecture, from the past as well as in the present. Plants are also living organisms, so they are related to their surroundings also release different things to surrounding environment, and they take different things from their surrounding. So there is a potential to change the arial environment. If this change can be explored, then the plants can be used to produce an efficient design.

Scrivens C 1980 in his interior planting in large buildings says "research studies have even suggested that Productivity may be increased by 10-15% through the introduction of plants"
This indicate the use of indoor plants fulfilling and satisfying human needs somehow, this can happen due to physical comfort as well as due to psychological comfort. So it is necessary to find out those and how much more effectively plants can be used in building designs. The physical comfort conditions established by a building interior or space is the result of the heating energy that gain or lose as people notified by warmness or coolness depending upon the surrounding air temperature relative humidity, air movement and surface temperature. Our clothing and activity level also affects the comfort level.

The building that architect's design is a protective envelope to be used like a layer of clothing around the spaces we inhabit. Architects can have two ways like adjusting the building different elements and options that are designed as a part of the permanent structure to achieve comfort conditions within a building. So use of different indoor plants in buildings for comfort can be said as an option in architecture. Many researchers mention using of plants for thermal control, but they did not state the method and best plant types or characters which give much comfort. It is necessary to find out this method especially in tropical countries like Sri Lanka for thermal control

purposes. Therefore this study intends to find how thermally comfortable environments could be achieved with indoor plants.

1.2 THE PROBLEM AND ITS SETTING

The plants are being used in building interiors for a very long time but the plants behavior in internal environment and their actual contribution, specially to the internal thermal environment in a building is largely unknown. The aim of this research is to investigate how the usage of indoor plants can contribute to thermal comfort in building interiors.

1.3 THE RESEARCH RATIONALE

An energy efficient and environmentally responsive building features very prominently in the current trends of architecture. Creating a good thermal environment is a major objective of these buildings. In other words, one of the major tasks of Eco-friendly architects is to create the best possible indoor environment to give maximum comfort for the users of their buildings. Therefore, an investigation of the contribution that indoor plants can make for thermal comfort in building interiors is an important area of study.

1.4 THE RESEARCH OBJECTIVES

The main objective of this project is to examine how plants affect the internal thermal environment in a building. It aims to find out how building interiors can be designed with the use of plants to obtain a satisfactory thermal environment.

The specific objectives are

1.Finding out how plants affect the principle physical variables in a microclimate. The main principle physical variables are;

- Air temperature
- Relative humidity

2.Finding out how the qualities of plants affect the internal conditions. The variables involved are;

- Variegation of plant (color)
- Leaf size

- No of plants
- Height of plants

1.5 HYPOTHESES

The main factors affecting the thermal comfort are air temperature and relative humidity. So the logical supposition of the hypotheses depend on these physical variables and how they are governed by indoor plants.

Hypotheses 1: Air temperature of the internal thermal environment in a building is affected by indoor plants.

Hypotheses 2: Relative humidity of the internal thermal environment in a building is affected by indoor plants.

The problems in this research are viewed through these two hypotheses. The possible sources of information that will aid in resolving the research problem are directly depending on these hypotheses.

1.6 THE ASSUMPTIONS

This study totally depends on the two principle variables of human thermal comfort, the air temperature and relative humidity. The other main variables in human thermal comfort, the surface temperature and Air movements are considered for this purpose of this study as constant.

1.7 THE METHOD OF STUDY

At the outset a pre-research on the demand and use of indoor plants was conducted to identify the most popular varieties of plants. This was mainly done by observations and by interviewing plant sellers. Observations will be done in different houses to find out what are the most common and widely used indoor plants. The plant sellers were interviewed to identify the varieties of indoor plants, which are in high demand.

1.7.1 THE POPULAR INDOOR PLANTS

The three types of popular plants chosen from the pre research are as follows.

1.7.1.1 Schefflera arboricola

This plant is commonly referred as finger plant and in Sinhala it is called 'pana tree'. The leaf is divided into small six sub leaves. The most common type of form it grows as a bush and there are 3 types of Schefftera plants with 3 colors (dark green, green leaves with small yellow patches and yellow leaves with small green patches). The leaves are not change annually. This plant type was chosen especially to observe how the colors of the plants contribute to the surrounding microclimate.

Fig. 1 . Schefflera aboricola plant

1.7.1.2. The different types of Palms

The different types of palms are very commonly used as indoor plants, from long time. There are different types of palms with different heights and different leaf shapes. The cane palm (Areca lutescens) and queen palms (Livistona rotundifolia) were chosen from this type of plants to

observe how the leaf shape of the plants contributes to the surrounding microclimate. The cane palms has large leaves divided into thin elongated sub leaves and queen palms has large palm like rough leaves.

Fig. 2 . The common palm types in Sri Lanka

1.7.1.3 Pleomela refexa

This is an another type of common indoor plant. This type is mostly used as large trees. Also they can use as small bushes of pot plants. So this was chosen to observe how the height of the plants contribute to the surrounding microclimate.

Fig .3. The common types of Plemela refexa plants

1.7.2 METHOD OF COLLECTION OF DATA

The numerical date necessary for the research procedure will be obtained using a model situation [model courtyard]. The model courtyard selected is situated in an urban house constructed in a ten perch land. This house has all daily routine and activities happening (heat gaining and heat losers) around the courtyard.
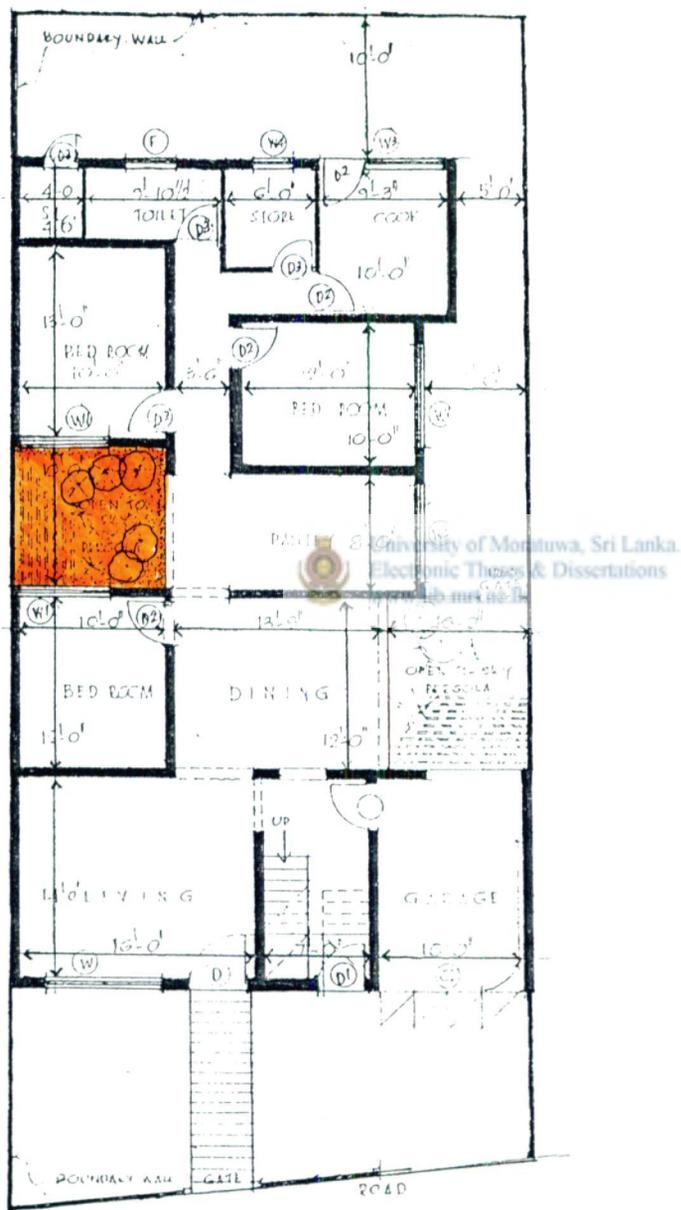
Fig. 4. The floor plan of the selected urban house (with the model courtyard)

The courtyard has 3m x 3m areas and 4m height. The number of plants used for the experiment related to the size of the courtyard and used one plant per m², except in one research, in that when plant number was increased and used 2 plants per m².

The data was taken at out side the house and inside the house (within the middle of the courtyard, 1.5m away from the middle of the courtyard and 3.5m away from the middle of the courtyard).

The data observing 3 positions are chosen in order to find out the air temperature and relative humidity in the middle of the courtyard. (Specially the data within the plants). The 1.5m away from the courtyard to find out the data that closes to courtyard/near the perimeter of the courtyard. The 3.5m away from the middle of the courtyard was to find out the data at a distance, not too close to the courtyard.

1.7.3 THE REQUIRED DATA

The data required for the experiment are as follows.

1. The outdoor air temperature and relative humidity.
2. Indoor air temperature and relative humidity.
Measure the two variables within the courtyard, 1.5m away from the courtyard, 3.5m away from the middle of the courtyard without plants.
3. Indoor air temperature and relative humidity.
Measure the two variables within the courtyard, 1.5m away from the courtyard, 3.5m away from the courtyard with plants; (The plants wit different colors, different leaf sizes, different height and different number of plants).

The data was taken during a whole day in every one-hour to observe any differences in the thermal environment with the use of plants.

To carry on the research it is necessary to study the background information, which related to the thermal comfort, as well as why and how plants use in building designs.