



## An assessment of phytosociological diversity of north Anjukudieruppu, Kanniyakumari district, Tamil Nadu, South India

Mary Kensa V<sup>1</sup>, Amzad Basha Kolar<sup>2\*</sup>, Beema Jainab S I<sup>3</sup>

<sup>1</sup> PG, Department of Botany and Research Centre, ST Hindu College, Nagercoil, Affiliated to the MS University, Tirunelveli, Tamil Nadu, India

<sup>2</sup> PG, Department of Botany, The New College (Autonomous), Affiliated to the University of Madras, Chennai, Tamil Nadu, India

<sup>3</sup> Department of Plant Biology and Plant Biotechnology, JBAS College for Women (Autonomous), Affiliated to the University of Madras, Chennai, Tamil Nadu, India

### Abstract

Phytosociological studies are indeed necessary for protecting the native plant species and also help us in understanding the changes in biodiversity. Hence these studies considered to be importance by most of the economically developed nations. A study was conducted in *North Anjukudieruppu* of Kanniyakumari district to assess the phytosociological studies in terms of trees, shrubs, herbs and climbers. A total number of 152 plant species belonging to 136 genera and 57 families are recorded in this study. Among 57 families, 34 families are from dicot plants and 11 families are monocots. The result further reveal that *Euphorbiaceae* is the most dominant family with 13 species followed by *Fabaceae* and *Malvaceae* with 8 species. The Habit-wise classification of the study area shows that herbs (46%) are dominant followed by trees (27%) and shrubs (24%). Similarly the study area, 50% of the species were found as wild plants, 41% as ornamental plants and 9% as cultivated plants. The commonly occurring species are *Cocos nucifera*, *Acalypha indica*, *Rosa sp.*, *Parthenium hysterophorus*, *Musa paradisiaca*, *Hibiscus rosa sinensis*, *Amaranthus blitum* and *Tectona grandis*. Phytosociological attributes such as Density, Frequency, Basal area, Relative Density (RD), Relative Frequency (RF) and Importance Value Index (IVI) of each plant from the study area were also calculated. This study may help us to understand the pattern of species diversity of micro and macro environments that influences the process of diversity on different communities.

**Keywords:** biodiversity, phytosociology, endemic, Kanniyakumari

### Introduction

The structure of nature and diversity patterns are affected by many environmental features such as altitude, rainfall, human disturbance and so on [1, 2]. Phytosociology is a branch of botany that deals with plant communities on characteristics, taxonomic, relationships and distributions. These studies are essential to understand the population dynamics of particular species with their relation on other species in the same community. To understand the characteristic features of floristic vegetation and to assess the species richness and diversity from the study area are principle aims of phytosociological studies. Although quantitative species data help us to understand the current scenario, usefulness and intensity of the anthropogenic pressure on individual species [3]. Hence, phytosociological data is essential for the management and conservation of ecology resulted with conservation management policies for species those facing threats [4].

The prime objective of the phytosociological studies may extended as to understand the vegetation patterns and to evaluate the species richness and diversity of the study area. Human society highly dependent on phytosociological diversity for day to day lives, livelihood, and other resources. Phytosociological studies plays significant role in conservation of native plant communities and biodiversity. It also help as to understand the changes among the diversity in evolutionary aspects. It influenced by both

biotic and a biotic factor of the ecosystems. India is ranked one of the world's top 17 mega-diversity nations, which has 60 – 70% of the earth's biodiversity resources. Vegetation is a key component of an ecosystem that has significant effects on the total environment. Managing species diversity is vital part in semi-arid environments in terms of maintenance and addition of plants [5].

Kanyakumari district is located in the tip of the mainland of India, with various types of ecosystems including coastal, forest, hilly, riparian, rural, urban and wetland ecosystems. These areas are occupied by dense vegetation that establish strong association with environmental factors. This association plays a significant role in the primary production, nutrient cycling, and biodiversity pattern. There are several investigation have been carried out to explore the floristic resources of Kanyakumari district by various researchers with reference to periodical intervals [6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17].

Although the phytosociological profile of the district is still found paucity, to fill this lacuna the present study was carried out in *North Anjukudieruppu* of Kanyakumari district. The prime objective of this study is to determine the influence of plant species on phytosociological parameters in the study area. Additionally to stratify the plant vegetation into different categories (climbers, herbs, shrubs & trees) and to analyze the community structure for density,

frequency, abundance and species girth class relationship of the study area.

## Materials and Methods

### Study Area

The study area *North Anjukudieruppu* is located in Thengamputhoor Panchayath of Kanniyakumari district, Tamil Nadu, South India (Fig.1). In ancient days there were

five houses and these houses were thatched with palm leaf, hence this location is referred as *North Anjukudieruppu*. But now there are 550 houses found in this area, which contains ponds, canals and small streams. This area is completely occupied with plants including wild, native, exotic and cultivated species. People of this area are found as daily wagers and self-employed with diversified religious practices.

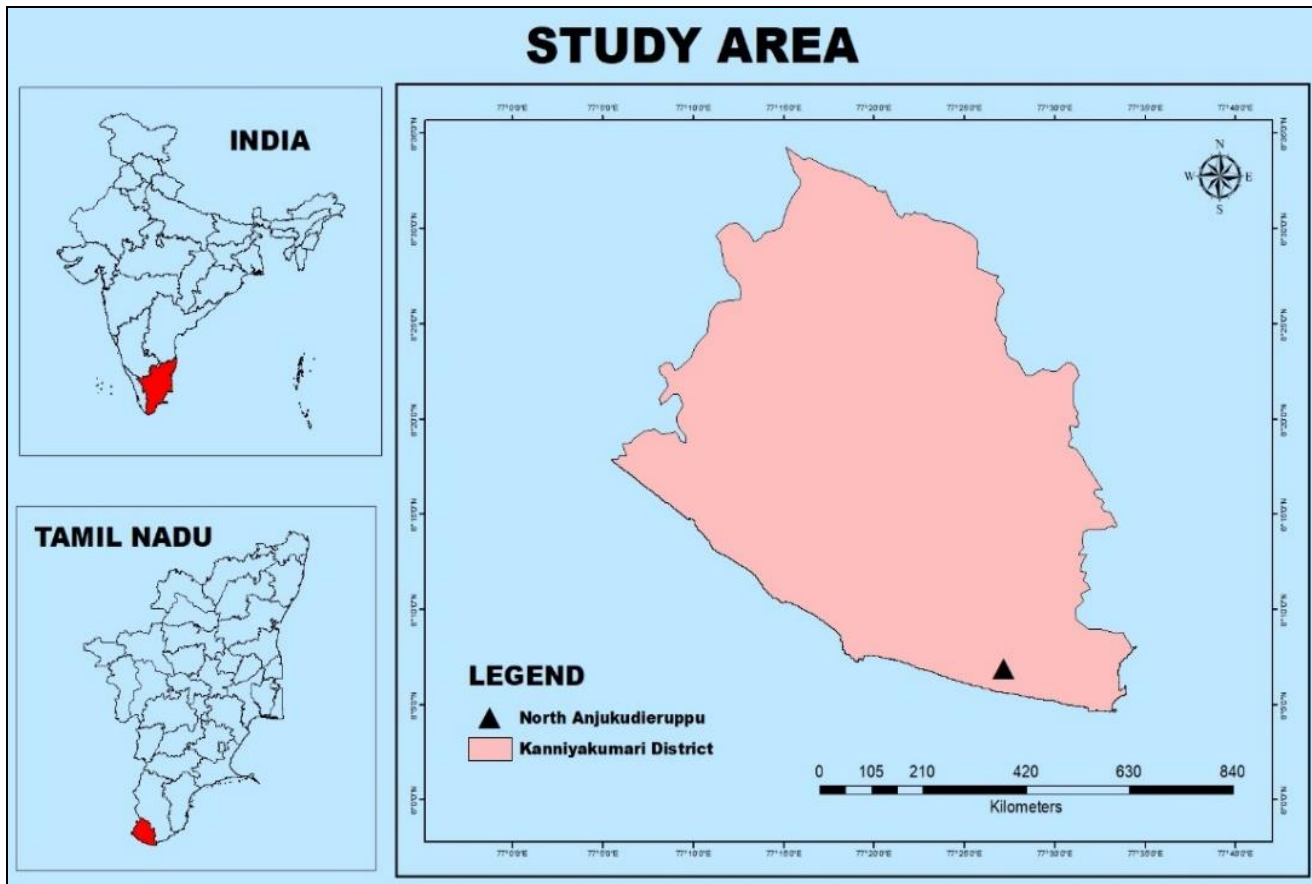


Fig 1: Map Showing the Study Area

The location maps of this study was created using software ArcGIS 10.3 Version 10.3.0.4322 © 1999 – 2012 Esri Inc.

### Data Collection

Phytosociological studies carried out in different seasons of 2017 to cover all spectrum of vegetation of the study area. The entire the study area was divided in to 6.25×6.25 km. Observation from each line transect were recorded for various quantitative characteristics like relative frequency, relative density and relative dominance were determined by following method of Bole and Pathak [18]. During this study collection of data majorly focuses on the botanical name, family, and habit of the plant species from the study area. Additionally plant specimens with field number were collected and recorded in the field note. The collected specimens are furtherly dried and mounted on the herbarium sheets and identified done with the help of existing literature [19, 20]. The prepared herbarium are deposited in the S.T. Hindu College, Nagercoil, Kanyakumari District, Tamil Nadu.

### Analysis of data

Different parameters such as Density, Frequency, Basal areas, Relative Density (RD), Relative Frequency (RF) and

Importance Value Index (IVI) were calculated for each species. The formula used are listed below [21].

$$\text{Density} = \frac{\text{Total number of individuals of a species}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{Frequency} = \frac{\text{Total number of quadrats in which the species occurred}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{Basal area} = \frac{cbh^2}{4\pi}$$

$$\text{Relative Density (\%)} = \frac{\text{number of individuals of a species}}{\text{number of individuals of all species}} \times 100$$

$$\text{Relative Frequency (\%)} = \frac{\text{Frequency of the species}}{\text{Frequency of all species}} \times 100$$

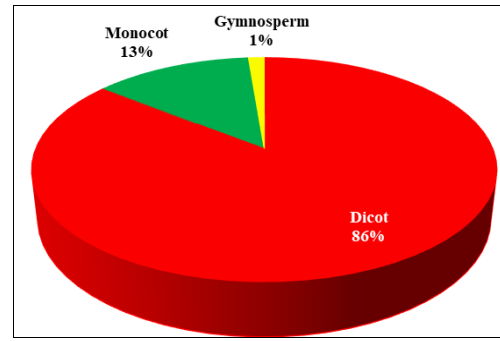
$$\text{Relative Dominance (\%)} = \frac{\text{Basal area of a species}}{\text{Basal area of all species}} \times 100$$

$$\text{Importance Value Index (IVI)} = \text{Relative Frequency} + \text{Relative Density} + \text{Relative Dominance}$$

**Results and Discussions**

The vegetation of *North Anjukudieruppu* was surveyed to assess the phytosociological studies in terms of trees, shrubs, herbs and climbers. The survey resulted with, a total number of 136 genera and 152 species belongs to 57 families from the study area (Table.1). In this investigation 57 families accounts dicots, monocots and gymnosperm with 34 families, 11 families and 2 families respectively. This reveals that the study area has justifiable amount of plant diversity and provide suitable conditions to them. Similarly Rampilla *et al* [22], Deepa *et al* [23], and Haftay [24] did phytosociological studies which was resulted with 146 species, 57 species and 69 species of angiosperms respectively. The result further reveals that the study area was predominant by dicotyledons with 86% followed by monocotyledons with 13% and gymnosperms with 1%

(Fig.2). Similarly the dominance of dicot plants were reported in Pachamalai hills by Amzad and Ghouse [25].



**Fig 2:** Graphical Representation of Division Recorded From the Study Area

**Table 1:** List of Species Recorded from North Anjukudieruppu, Kanniyakumari District

S. No	Division	Family	Name of the Species	Habit	Nature
1	Dicot	Malvaceae	<i>Abelmoschus esculentus</i> (L.) Moench	Herb	Cultivated
2	Dicot	Malvaceae	<i>Abutilon indicum</i> (Link) Sweet	Herb	Wild
3	Dicot	Euphorbiaceae	<i>Acalypha indica</i> L.	Herb	Wild
4	Dicot	Apocynaceae	<i>Adenium obesum</i> (forssk.) Roem & Schult	Shrub	Cultivated
5	Dicot	Acanthaceae	<i>Adhatoda vasica</i> Nees	Shrub	Wild
6	Dicot	Rutaceae	<i>Aegle marmelos</i> (L.) Correa	Tree	Wild
7	Dicot	Amaranthaceae	<i>Aerva lanata</i> (L.)Juss. exSchult	Herb	Wild
8	Dicot	Fabaceae	<i>Albizia lebbek</i> (L) Benth.	Tree	Wild
9	Dicot	Apocynaceae	<i>Allamanda cathartica</i> L.	Shrub	Ornamental
10	Monocot	Liliaceae	<i>Aloe vera</i> (L.)Burm. f.	Herb	Cultivated
11	Dicot	Amaranthaceae	<i>Alternanthera ficoidea</i> (L.) Sm	Herb	Cultivated
12	Dicot	Amaranthaceae	<i>Amaranthus blitum</i> L.	Tree	Wild
13	Dicot	Anacardiaceae	<i>Anacardium occidentale</i> L.	Tree	Wild
14	Dicot	Annonaceae	<i>Annona reticulata</i> L.	Tree	Wild
15	Dicot	Annonaceae	<i>Annona squamosa</i> L.	Tree	Wild
16	Gymnosperm	Araucariaceae	<i>Aracauria araucana</i> (Molina) k. Koch	Tree	Ornamental
17	Monocot	Arecaceae	<i>Areca catechu</i> L.	Tree	Cultivated
18	Dicot	Moraceae	<i>Artocarpus heterophyllus</i> (Lam)	Tree	Cultivated
19	Monocot	Liliaceae	<i>Asparagus plumosus</i> Baker	Shrub	Ornamental
20	Dicot	Meliaceae	<i>Azadirachta indica</i> A. Juss	Tree	Wild
21	Monocot	Poaceae	<i>Bambusa arundinacea</i> (Retz.) willd	Tree	Cultivated
22	Dicot	Acanthaceae	<i>Barleria cristata</i> L.	Herb	Wild
23	Dicot	Malvaceae	<i>Bombax ceiba</i> L.	Tree	Wild
24	Dicot	Nyctaginaceae	<i>Bougainvillea spectabilis</i> willd.	Shrub	Ornamental
25	Monocot	Crassulaceae	<i>Bryophyllum pinnatum</i> (Lam.) Oken	Herb	Cultivated
26	Dicot	Caesalpinaceae	<i>Caesalpinia pulcherrima</i> (L.) Sw	Tree	Wild
27	Monocot	Araceae	<i>Caladium bicolor</i> Vent.	Herb	Ornamental
28	Dicot	Asclepiadaceae	<i>Calotropis gigantea</i> (L.) W.T Aiton	Herb	Wild
29	Dicot	Solanaceae	<i>Capsicum annum</i> L.	Herb	Cultivated
30	Dicot	Sapindaceae	<i>Cardiospermum halicacabum</i> L.	Climber	Wild
31	Dicot	Caricaceae	<i>Carica papaya</i> L.	Tree	Cultivated
32	Dicot	Apocynaceae	<i>Carissa carandas</i> L.	Shrub	Wild
33	Dicot	Fabaceae	<i>Cassia fistula</i> L.	Tree	Wild
34	Dicot	Caesalpinaceae	<i>Cassia occidentalis</i> (L.) Link	Herb	Wild
35	Monocot	Casuarinaceae	<i>Casuarina equisetifolia</i> L.	Tree	Wild
36	Dicot	Apocynaceae	<i>Catharanthus roseus</i> (L.) G. Don	Herb	Wild
37	Dicot	Amaranthaceae	<i>Celosia argentea</i> (L.)	Herb	Cultivated
38	Dicot	Asteraceae	<i>Chrysanthemum indicum</i> L.	Herb	Cultivated
39	Dicot	Euphorbiaceae	<i>Cicca disticha</i> L.	Tree	Cultivated
40	Dicot	Rutaceae	<i>Citrus aurantifolia</i> Swingle.	Shrub	Cultivated
41	Dicot	Capparaceae	<i>Cleome viscosa</i> L.	Herb	Wild
42	Monocot	Arecaceae	<i>Cocus nucifera</i> L.	Tree	Cultivated
43	Dicot	Lamiaceae	<i>Coleus amboinicus</i> Lour.	Herb	Wild
44	Dicot	Lamiaceae	<i>Coleus blumei</i> L.	Herb	Ornamental
45	Monocot	Asparagaceae	<i>Cordyline fruticosa</i> (L.) A. Chev.	Tree	Cultivated
46	Monocot	Amaryllidaceae	<i>Crinum asiaticum</i> L.	Herb	Cultivated
47	Monocot	Amaryllidaceae	<i>Crinum powellii</i> Rosea.	Herb	Cultivated

48	Dicot	Acanthaceae	<i>Crossandra infundibuliformis</i> (L.) Nees	Herb	Wild
49	Dicot	Acanthaceae	<i>Crossandra nilotica</i> Oliv.	Herb	Cultivated
50	Dicot	Fabaceae	<i>Crotalaria retusa</i> L.	Herb	Wild
51	Dicot	Euphorbiaceae	<i>Croton sparsiflorus</i> Morong.	Herb	Wild
52	Gymnosperm	Cupressaceae	<i>Cupressus macrocarpa</i> Hartw.	Tree	Ornamental
53	Monocot	Zingiberaceae	<i>Curcuma longa</i> L.	Herb	Cultivated
54	Dicot	Solanaceae	<i>Datura metal</i> L.	Herb	Wild
55	Monocot	Araceae	<i>Dieffenbachia seguine</i> (Jacq.)Schott.	Shrub	Wild
56	Monocot	Liliaceae	<i>Dracaena deremensis</i> (Vand. ex L.)	Tree	Cultivated
57	Monocot	Liliaceae	<i>Dracaena reflexa</i> Lam	Tree	Wild
58	Dicot	Verbenaceae	<i>Duranta plumieri</i> Jacq	Shrub	Cultivated
59	Dicot	Euphorbiaceae	<i>Euphorbia hirta</i> L.	Herb	Wild
60	Dicot	Euphorbiaceae	<i>Euphorbia milii</i> Des moult.	Herb	Wild
61	Dicot	Euphorbiaceae	<i>Euphorbia tirucalli</i> L.	Herb	Wild
62	Dicot	Euphorbiaceae	<i>Euphorbia trigona</i> Mill.	Herb	Wild
63	Dicot	Moraceae	<i>Ficus benghalensis</i> L.	Tree	Wild
64	Dicot	Amaranthaceae	<i>Gomphrena globosa</i> L.	Herb	Ornamental
65	Dicot	Acanthaceae	<i>Graptophyllum pictum</i> (L.) Griff.	Herb	Wild
66	Dicot	Capparaceae	<i>Gynandropsis pentaphylla</i> (L.) Dc	Herb	Wild
67	Dicot	Boraginaceae	<i>Heliotropium indicum</i> L.	Herb	Wild
68	Dicot	Malvaceae	<i>Hibiscus rosa sinensis</i> L.	Shrub	Cultivated
69	Dicot	Malvaceae	<i>Hibiscus schizopetalus</i> (Dyer) Hook. f.	Shrub	Cultivated
70	Dicot	Lamiaceae	<i>Hyptis suaveolens</i> (L.) Poit.	Herb	Wild
71	Dicot	Balsaminaceae	<i>Impatiens balsamina</i> L.	Herb	Ornamental
72	Dicot	Fabaceae	<i>Indigofera tinctoria</i> L.	Herb	Wild
73	Dicot	Convolvulaceae	<i>Ipomoea quamoclit</i> L.	Climber	Ornamental
74	Dicot	Rubiaceae	<i>Ixora coccinea</i> L.	Shrub	Ornamental
75	Dicot	Oleaceae	<i>Jasminum grandiflorum</i> L.	Shrub	Cultivated
76	Dicot	Oleaceae	<i>Jasminum malabaricum</i> Wight	Shrub	Cultivated
77	Dicot	Oleaceae	<i>Jasminum sambac</i> (L.) Aiton	Shrub	Cultivated
78	Dicot	Euphorbiaceae	<i>Jatropha gossypifolia</i> L.	Shrub	Cultivated
79	Dicot	Euphorbiaceae	<i>Jatropha hastata</i> Jacq.	Shrub	Wild
80	Dicot	Crassulaceae	<i>Kalanchoe pinnata</i> L.	Shrub	Cultivated
81	Dicot	Crassulaceae	<i>Kalanchoe marnieriana</i> H. Jacobsen	Shrub	Cultivated
82	Dicot	Verbenaceae	<i>Lantana camara</i> L.	Shrub	Wild
83	Dicot	Lythraceae	<i>Lawsonia inermis</i> L.	Tree	Wild
84	Dicot	Onagraceae	<i>Ludwigia parviflora</i> L.	Herb	Wild
85	Dicot	Solanaceae	<i>Lycopersicon esculentum</i> Mill.	Herb	Cultivated
86	Dicot	Malvaceae	<i>Malvastrum coromandelianum</i> (L.) Garcke	Herb	Wild
87	Dicot	Anacardiaceae	<i>Mangifera indica</i> L.	Tree	Wild
88	Dicot	Euphorbiaceae	<i>Manihot esculenta</i> Crantz	Shrub	Cultivated
89	Dicot	Sapotaceae	<i>Manilkara zapota</i> (L.) P. Royen	Tree	Cultivated
90	Dicot	Nyctaginaceae	<i>Mirabilis jalapa</i> L.	Herb	Cultivated
91	Dicot	Rubiaceae	<i>Morinda tinctoria</i> Roxb.	Tree	Wild
92	Dicot	Moringaceae	<i>Moringa oleifera</i> Lam.	Tree	Cultivated
93	Dicot	Moraceae	<i>Morus rubra</i> L.	Tree	Wild
94	Dicot	Tiliaceae	<i>Muntingia calabura</i> L.	Shrub	Cultivated
95	Dicot	Rutaceae	<i>Murraya koenigii</i> (L.) Sprengel	Shrub	Cultivated
96	Monocot	Musaceae	<i>Musa paradisiaca</i> L.	Tree	Cultivated
97	Dicot	Lamiaceae	<i>Ocimum sanctum</i> L.	Herb	Cultivated
98	Dicot	Cactaceae	<i>Opuntia cochenillifera</i> (L.) Mill.	Herb	Wild
99	Dicot	Asteraceae	<i>Osteospermum ecklonis</i> (DC.) Norl.	Shrub	Ornamental
100	Dicot	Pandanaceae	<i>Pandanus amaryllifolius</i> Roxb.	Tree	Wild
101	Dicot	Asteraceae	<i>Parthenium hysterophorus</i> L.	Herb	Wild
102	Dicot	Pedaliaceae	<i>Pedaliium murex</i> L.	Herb	Wild
103	Dicot	Euphorbiaceae	<i>Pedilanthus tithymaloides</i> L.	Shrub	Cultivated
104	Dicot	Cactaceae	<i>Pereskia bleo</i> (Kunth) Dc.	Climber	Cultivated
105	Dicot	Verbenaceae	<i>Petrea volubilis</i> L.	Tree	Cultivated
106	Monocot	Arecaceae	<i>Phoenix pusilla</i> Roxb.	Herb	Wild
107	Dicot	Euphorbiaceae	<i>Phyllanthus amarus</i> L.	Herb	Cultivated
108	Dicot	Piperaceae	<i>Piper longum</i> L.	Tree	Wild
109	Dicot	Fabaceae	<i>Pithecellobium dulce</i> (Roxb) Benth	Herb	Wild
110	Dicot	Verbenaceae	<i>Plumbago zeylanica</i> L.	Herb	Wild
111	Dicot	Apocynaceae	<i>Plumeria pudica</i> Jacq.	Shrub	Cultivated
112	Dicot	Araliaceae	<i>Polyscias balfouriana</i> (Andre). L.H. Bailry.	Shrub	Cultivated
113	Dicot	Araliaceae	<i>Polyscias paniculata</i> (DC.) Barker	Herb	Cultivated
114	Dicot	Araliaceae	<i>Polyscias scutellaria</i> (Burm. f) Fosberg.	Herb	Cultivated
115	Dicot	Fabaceae	<i>Pongamia pinnata</i> (L.) Panigahi	Tree	Wild

116	Dicot	Portulacaceae	<i>Portulaca grandiflora</i> Hook.	Herb	Cultivated
117	Dicot	Portulacaceae	<i>Portulaca oleracea</i> L.	Herb	Cultivated
118	Dicot	Fabaceae	<i>Prosopis juliflora</i> (SW.)DC	Tree	Wild
119	Dicot	Rosaceae	<i>Prunus avium</i> (L)	Tree	Cultivated
120	Dicot	Acanthaceae	<i>Pseuderanthemum carruther sii.</i> (seem.) Guillaumin	Herb	Cultivated
121	Dicot	Acanthaceae	<i>Pseuderanthemum reticulatum</i> L.	Herb	Cultivated
122	Dicot	Myrtaceae	<i>Psidium guajava</i> L.	Tree	Cultivated
123	Dicot	Punicaceae	<i>Punica granatum</i> L.	Shrub	Wild
124	Dicot	Combretaceae	<i>Quisqualis indica</i> L.	Climber	Wild
125	Dicot	Euphorbiaceae	<i>Ricinus communis</i> L.	Shrub	Wild
126	Dicot	Rosaceae	<i>Rosa</i> sp.	Herb	Cultivated
127	Monocot	Poaceae	<i>Saccharum officinarum</i> L.	Shrub	Cultivated
128	Monocot	Liliaceae	<i>Sansevieria trifusciata</i> prain.	Herb	Cultivated
129	Dicot	Santalaceae	<i>Santalum album</i> Linn.	Tree	Wild
130	Dicot	Malvaceae	<i>Sida acuta</i> Burm. f.	Herb	Wild
131	Dicot	Solanaceae	<i>Solanum melongena</i> L.	Herb	Cultivated
132	Dicot	Solanaceae	<i>Solanum surattense</i> Burm f.	Herb	Wild
133	Dicot	Solanaceae	<i>Solanum torvum</i> Sw.	Herb	Cultivated
134	Dicot	Rubiaceae	<i>Spermacoce hispida</i> L.	Herb	Wild
135	Dicot	Apocynaceae	<i>Tabernaemontana divaricata</i> R.Br.ex Roem.& Schult	Shrub	Ornamental
136	Dicot	Asteraceae	<i>Tagetes erecta</i> L.	Herb	Cultivated
137	Dicot	Portulacaceae	<i>Talinum portulacifolium</i> (forssk.) Asch. ex. Schweinf.	Herb	Wild
138	Dicot	Fabaceae	<i>Tamarindus indica</i> L.	Tree	Wild
139	Dicot	Bignoniaceae	<i>Tecoma stans</i> (L.) Juss ex kunth.	Shrub	Cultivated
140	Dicot	Bignoniaceae	<i>Tecomaria capensis</i> (Thunb.) lindl.	Shrub	Cultivated
141	Dicot	Verbenaceae	<i>Tectona grandis</i> L.	Tree	Wild
142	Dicot	Malvaceae	<i>Thespesia populnea</i> (L.) sol.ex Correa.	Tree	Wild
143	Dicot	Apocynaceae	<i>Thevetia peruviana</i> (pers.) k. schum.	Shrub	Wild
144	Dicot	Asteraceae	<i>Tithonia diversifolia</i> (Hemsl.) A. Gray.	Shrub	Wild
145	Monocot	Commelinaceae	<i>Tradescantia spathacea</i> Sw.	Herb	Wild
146	Dicot	Verbenaceae	<i>Vitex negundo</i> L.	Shrub	Wild
147	Dicot	Asteraceae	<i>Wedelia chinensis</i> (Osbeck) Merr.	Herb	Wild
148	Dicot	Asteraceae	<i>Xanthium strumarium</i> L.	Herb	Wild
149	Monocot	Amaryllidaceae	<i>Zephyranthes rosea</i> Lindl.	Herb	Wild
150	Monocot	Zingiberaceae	<i>Zingiber officinale</i> Roscoe.	Herb	Cultivated
151	Dicot	Asteraceae	<i>Zinnia elegans</i> Jacq.	Herb	Cultivated
152	Dicot	Rhamnaceae	<i>Ziziphus jujuba</i> Mill.	Shrub	Wild

During this study families such as *Acanthaceae*, *Amaranthaceae*, *Amaryllidaceae*, *Anacardiaceae*, *Annonaceae*, *Apocynaceae*, *Araceae*, *Araliaceae*, *Araucariaceae*, *Arecaceae*, *Asclepiadaceae*, *Asparagaceae*, *Asteraceae*, *Balsaminaceae*, *Bignoniaceae*, *Boraginaceae*, *Cactaceae*, *Caesalpinaceae*, *Capparaceae*, *Caricaceae*, *Casuarinaceae*, *Combretaceae*, *Commelinaceae*, *Convolvulaceae*, *Crassulaceae*, *Cupressaceae*, *Euphorbiaceae*, *Fabaceae*, *Lamiaceae*, *Liliaceae*, *Lythraceae*, *Malvaceae*, *Meliaceae*, *Moraceae*, *Moringaceae*, *Musaceae*, *Myrtaceae*, *Nyctaginaceae*, *Oleaceae*, *Onagraceae*, *Pandanaceae*, *Pedaliaceae*, *Piperaceae*, *Poaceae*, *Portulacaceae*, *Punicaceae*, *Rhamnaceae*, *Rosaceae*, *Rubiaceae*, *Rutaceae*, *Santalaceae*, *Sapindaceae*, *Sapotaceae*, *Solanaceae*, *Tiliaceae*, *Verbenaceae*, and *Zingiberaceae* were reported.

In which family *Euphorbiaceae* was found dominant with 13 species. *Fabaceae* and *Malvaceae* was second dominant families each reported with 8 species, followed by, *Acanthaceae*, and *Apocynaceae* (Fig.3). Similarly Deepa *et al.* [23], (2017) and Amzad *et al.* [26] documented the dominance of *Euphorbiaceae* members in their studies carried out in plants associated with Thrissur district of Kerala and Medavakkam Lake of Tamil Nadu respectively. The study area was dominated by the members of *Euphorbiaceae* family. This family is familiar for production of large number of seeds which is helpful in sexual reproduction and it also possess different types of

vegetative reproduction. The dominance of *Acalypha indica*, *Euphorbia hirta* and *Phyllanthus amara* in the study area is because of the study area is one of the important pastoralist routes. Since the grazing is facilitate the seeds dispersal and activation of vegetative buds among these fodder plants.

The study was resulted with absence of endemic species, wherein the commonly occurring species such as *Cocos nucifera*, *Acalypha indica*, *Rosa sp.*, *Parthenium hysterophorus*, *Musa paradisiaca*, *Hibiscus rosa sinensis*, *Amaranthus blitum* and *Tectona grandis* were documented. The dominant tree species found in the study area include *Cocos nucifera*, *Musa paradisiaca*, followed by *Tectona grandis*. The dominant species are contribute the greatest proportion of the production and playing an important role in constituting community dynamics and regulating ecosystem processes [27, 28, 29].

The Habit-wise classification of the study area furtherly reveals that the herbs (46%) are dominant followed by trees (27%) and shrubs (24%). The climbers from the study area accounts 3% only (Fig.4). Similarly the dominance of herbaceous plant was also documented by Karthigeyan *et al.* [30], Muralidharan [31], and Keya and Rahman [32] in their studies. Out of 152 species documented from the study area, 76 species (50%) were found as wild plants, 64 species (41%) as ornamental plants and 13 species (9%) as cultivated plants (Fig.5). The dominance of wild varieties of plants indicates the natural wealth of the study area.

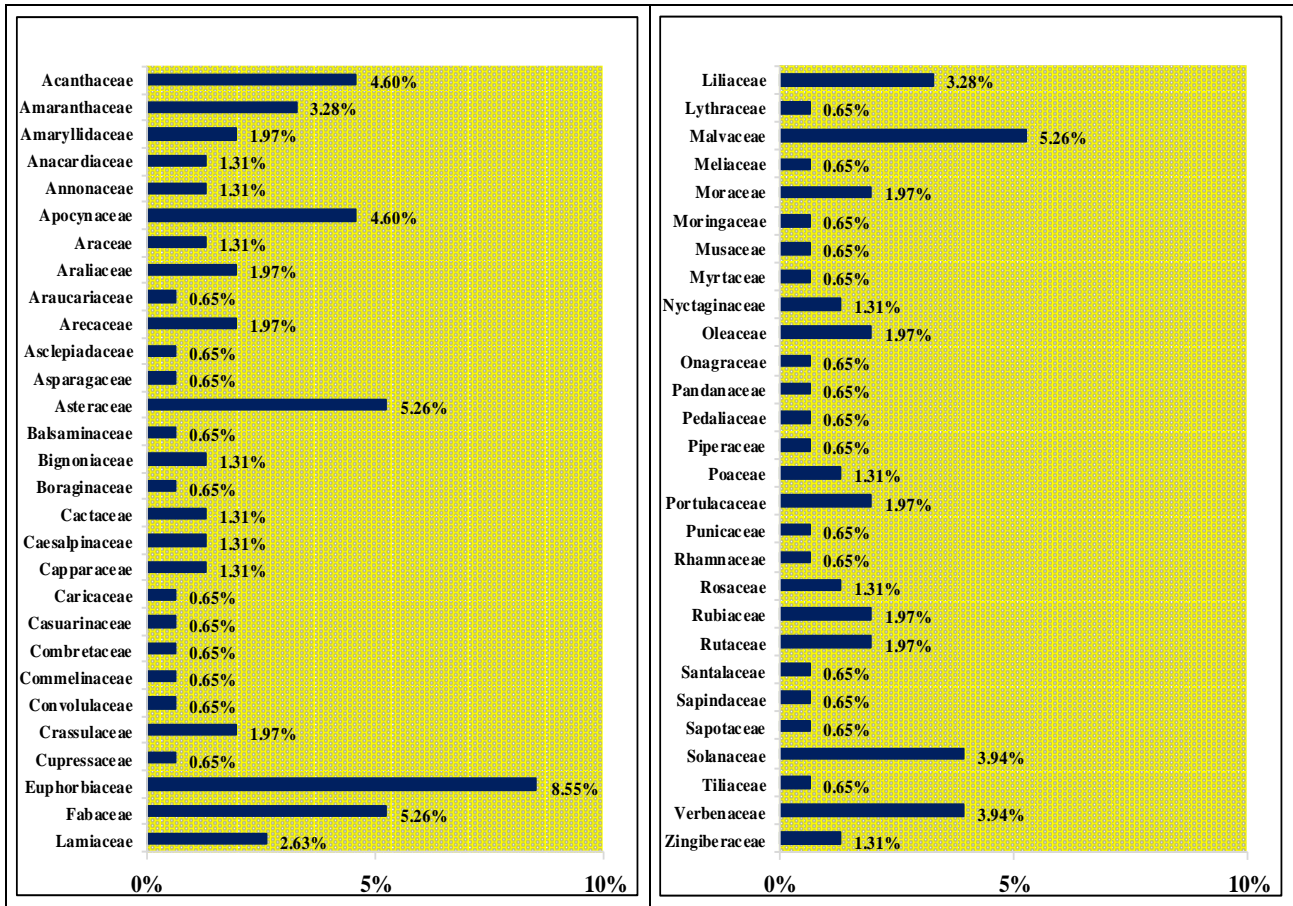


Fig 3: Bar Diagram is Showing Percentages of Families Reported in The Study Area

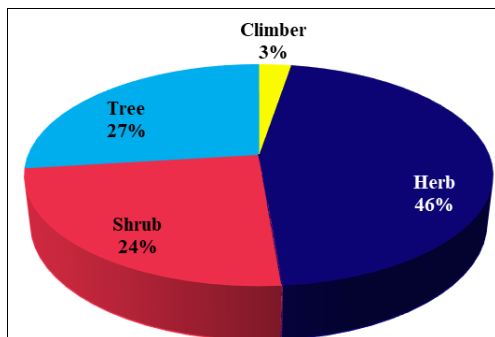


Fig 4: Habit Nature of the Plants from the Study Area

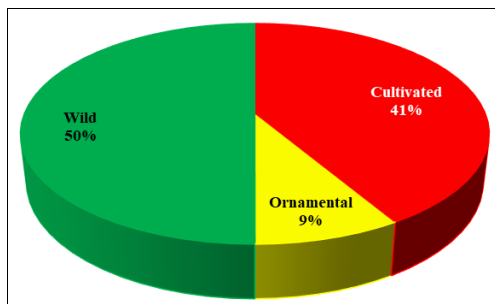


Fig 5: Graphical Representation Nature of Plants from the Study Area

Phytosociological attributes such as Density, Frequency, Basal area, Relative Density (RD), Relative Frequency (RF) and Importance Value Index (IVI) of each plant from the study area is given in Table.2. Highest amount of density was found in *Acalypha indica*, *Aloe vera*, *Anacardium*

*occidentale*, & *Annona squamosa* and lowest in *Aralia sp.*, *Areca catechu*, *Bambusa arundinaceae*, *Bombax ceiba*, *Caesalpinia pulcherima*, & *Cassia fistula*. Highest frequency (100) was observed in *Anacardium occidentale* followed by *Azadirachta indica*, *Calotropis gigantean* and *Capsicum annuum*. Least frequency (33.33) was noted in *Abelmoschus esculentus* followed by *Adenium obesum*, *Alternanthera ficoidea*, and *Araucaria araucana*. Thus the study area was found with species richness and less evenness. According to Wilsey and Stirling [33] richness and evenness can be negatively related across the plant communities, and evenness can account for more variation in Shannon’s diversity index (H) than richness.

The ranges of basal area was found between 0.01 and 225.33. Further it was found that *Ficus bengalensis* had highest basal area (225.33) followed by *Tamarindus indica* (152.04). Least amount of basal area (0.01) was found in plants like *Albizia lebbek*, *Bombax ceiba*, *Phoenix pusilla*, *Phyllanthus amarus*, *Alternanthera ficoidea* and *Abutilon indicum*. The highest relative density (0.87) of the study was documented in plants like *Acalypha indica*, *Aloe vera*, *Azadirachta indica* and *Carica papaya*. Wherein least amount of relative density (0.29) was found in *Abelmoschus esculentus*, *Araucaria araucana*, *Aralia sp.*, *Areca catechu*, *Bambusa arundinaceae*, *Bombax ceiba* etc. Species such as *Acalypha indica*, *Aloe vera*, *Anacardium occidentale*, *Annona squamosa*, and *Azadirachta indica* had highest relative frequency (1.19) and least relative frequency (0.39) was reported in *Abelmoschus esculentus*, *Alternanthera ficoidea*, *Aralia sp.*, *Areca catechu*, *Bambusa arundinaceae*, *Bombax ceiba*, *Caesalpinia pulcherima*, *Capsicum annuum*.

Table 2: Phytosociological Attributes of Study Area

S. No	Name of the Species	Density	Frequency	Basal area	Relative Density (RD)	Relative Frequency (RF)	Importance Value Index (IVI)
1	<i>Abelmoschus esculentus</i> (L.) Moench	0.33	33.33	0.62	0.29	0.39	1.01
2	<i>Abutilon indicum</i> (Link) Sweet	0.66	66.66	0.01	0.57	0.79	2.02
3	<i>Acalypha indica</i> L.	1	100	0.01	0.87	1.19	3.06
4	<i>Adenium obesum</i> (forssk.) Roem & Schult	0.33	33.33	1.75	2.29	0.39	3.01
5	<i>Adhatoda vasica</i> Nees	0.66	66.66	1.61	0.57	0.79	2.02
6	<i>Aegle marmelos</i> (L.) Correa	0.66	66.66	35.78	0.57	0.79	2.02
7	<i>Aerva lanata</i> (L.) Juss. exSchult	0.66	66.66	0.13	0.57	0.79	2.02
8	<i>Albizia lebbek</i> (L.) Benth.	0.66	66.66	58.04	0.57	0.79	2.02
9	<i>Allamanda cathartica</i> L.	0.66	66.66	4.47	0.57	0.79	2.02
10	<i>Aloe vera</i> (L.) Burm. f.	1	100	1.4	0.87	1.19	1.19
11	<i>Alternanthera ficoidea</i> (L.) Sm	0.33	33.33	0.01	0.28	0.39	1.01
12	<i>Amaranthus blitum</i> L.	0.66	66.66	0.23	0.57	0.79	2.02
13	<i>Anacardium occidentale</i> L.	1	100	29.04	0.87	1.19	3.06
14	<i>Annona reticulata</i> L.	0.66	66.66	6.02	0.57	0.79	2.02
15	<i>Annona squamosa</i> L.	1	100	9.45	0.87	1.19	3.06
16	<i>Aracauria araucana</i> (Molina) k. Koch	0.33	33.33	1.61	0.29	0.39	1.01
17	<i>Areca catechu</i> L.	0.33	33.33	16.73	0.29	0.39	1.01
18	<i>Artocarpus heterophyllus</i> (Lam)	0.66	66.66	71.17	0.57	0.79	2.02
19	<i>Asparagus plumosus</i> Baker	0.66	66.66	0	0.57	0.79	2.02
20	<i>Azadirachta indica</i> A. Juss	1	100	4.24	0.87	1.19	3.06
21	<i>Bambusa arundinacea</i> (Retz.) Willd	0.33	33.33	6.88	0.29	0.39	1.01
22	<i>Barleria cristata</i> L.	0.66	66.66	0.23	0.57	0.79	2.02
23	<i>Bombax ceiba</i> L.	0.33	66.66	59.33	0.29	0.39	1.01
24	<i>Bougainvillea spectabilis</i> Willd.	0.66	3.33	0.97	0.57	0.79	2.02
25	<i>Bryophyllum pinnatum</i> (Lam.) Oken	0.66	33.33	1.21	0.57	0.79	2.02
26	<i>Caesalpinia pulcherrima</i> (L.) Sw	0.33	100	5.35	0.29	0.39	1.01
27	<i>Caladium bicolor</i> Vent.	0.33	33.33	1.14	0.29	0.39	1.01
28	<i>Calotropis gigantea</i> (L.) W.T Aiton	1	100	0.66	0.86	1.19	3.06
29	<i>Capsicum annuum</i> L.	0.33	100	0.38	0.29	0.39	1.01
30	<i>Cardiospermum halicacabum</i> L.	1	33.33	0.11	0.87	1.19	3.06
31	<i>Carica papaya</i> L.	1	33.33	6.02	0.87	1.19	3.06
32	<i>Carissa carandas</i> L.	0.33	33.33	1.83	0.29	0.39	1.01
33	<i>Cassia fistula</i> L.	0.33	66.66	7.64	0.29	0.39	1.01
34	<i>Cassia occidentalis</i> (L.) Link	0.33	100	1.33	0.29	0.39	1.01
35	<i>Casuarina equisetifolia</i> L.	0.66	66.66	1.47	0.57	0.79	2.02
36	<i>Catharanthus roseus</i> (L.) G. Don	1	66.66	0.114	0.87	1.19	3.06
37	<i>Celosia argentea</i> (L.)	0.66	66.66	2.15	0.57	0.79	2.02
38	<i>Chrysanthemum indicum</i> L.	0.66	100	0.03	0.57	0.79	2.02
39	<i>Cicca disticha</i> L.	0.66	66.66	4.12	0.57	0.79	2.02
40	<i>Citrus aurantifolia</i> Swingle.	1	100	7.96	0.57	1.19	3.06
41	<i>Cleome viscosa</i> L.	0.66	66.66	0.01	0.57	0.79	2.02
42	<i>Cocus nucifera</i> L.	1	100	72.61	0.87	1.19	3.06
43	<i>Coleus amboinicus</i> Lour.	0.66	66.66	0.66	0.57	0.79	2.02
44	<i>Coleus blumei</i> L.	0.66	66.66	0.23	0.57	0.79	2.02
45	<i>Cordyline fruticosa</i> (L.) A. Chev.	0.66	66.66	0.46	0.57	0.79	2.02
46	<i>Crinum asiaticum</i> L.	0.66	66.66	4.47	0.57	0.79	2.02
47	<i>Crinum powellii</i> Rosea.	0.66	100	1.83	0.57	0.79	2.02
48	<i>Crossandra infundibuliformis</i> (L.) Nees	1	33.33	0.23	0.86	1.19	3.06
49	<i>Crossandra nilotica</i> Oliv.	0.33	100	0.49	0.28	0.39	1.01
50	<i>Crotalaria retusa</i> L.	1	100	0.49	0.86	1.19	3.06
51	<i>Croton sparsiflorus</i> Morong.	1	66.66	0	0.86	1.19	3.06
52	<i>Cupressus macrocarpa</i> Hartw.	0.66	66.66	0.62	0.57	0.79	2.02
53	<i>Curcuma longa</i> L.	0.66	66.66	0.58	0.57	0.79	2.02
54	<i>Datura metal</i> L.	0.66	66.66	0.07	0.57	0.79	2.02
55	<i>Dieffenbachia seguine</i> (Jacq.) Schott.	0.66	33.33	0.92	0.57	0.79	2.02
56	<i>Dracaena deremensis</i> (Vand. ex L.)	0.33	100	2.15	0.29	0.39	1.01
57	<i>Dracaena reflexa</i> Lam	0.33	66.66	1.33	0.29	0.39	1.01
58	<i>Duranta plumieri</i> Jacq	1	66.66	4.12	0.87	1.19	3.06
59	<i>Euphorbia hirta</i> L.	0.66	33.33	0.23	0.57	0.79	2.02
60	<i>Euphorbia milii</i> Des moul.	0.66	66.66	1.83	0.57	0.79	2.02
61	<i>Euphorbia tirucalli</i> L.	0.33	66.66	3.06	0.29	0.39	1.01
62	<i>Euphorbia trigona</i> Mill.	0.66	66.66	1.21	0.57	0.79	2.02
63	<i>Ficus benghalensis</i> L.	0.66	66.66	225.33	0.57	0.79	2.02

64	<i>Gomphrena globosa</i> L.	0.66	66.66	0.114	0.57	0.79	2.02
65	<i>Graptophyllum pictum</i> (L.) Griff.	0.66	66.66	0.58	0.57	0.79	2.02
66	<i>Gynandropsis pentaphylla</i> (L.) Dc	0.66	66.66	0	0.57	0.79	2.02
67	<i>Heliotropium indicum</i> L.	0.33	33.33	0.02	0.29	0.39	1.01
68	<i>Hibiscus rosa sinensis</i> L.	1	100	1.14	0.87	1.19	3.06
69	<i>Hibiscus schizopetalus</i> (Dyer) Hook. f.	0.66	66.66	2.49	0.57	0.79	2.02
70	<i>Hyptis suaveolens</i> (L.) Poit.	0.66	66.66	0.06	0.57	0.79	2.02
71	<i>Impatiens balsamina</i> L.	0.66	66.66	0.15	0.57	0.79	2.02
72	<i>Indigofera tinctoria</i> L.	1	100	0.03	0.87	1.19	3.06
73	<i>Ipomoea quamoclit</i> L.	0.33	33.33	0.11	0.29	0.39	1.01
74	<i>Ixora coccinea</i> L.	0.66	66.66	1.75	0.57	0.79	2.02
75	<i>Jasminum grandiflorum</i> L.	1	100	0.35	0.87	1.19	3.06
76	<i>Jasminum malabaricum</i> Wight	1	100	0.31	0.87	1.19	3.06
77	<i>Jasminum sambac</i> (L.) Aiton	1	100	0.42	0.87	1.19	3.06
78	<i>Jatropha gossypifolia</i> L.	0.33	33.33	1.14	0.29	0.39	1.01
79	<i>Jatropha hastata</i> Jacq.	0.66	66.66	1.56	0.57	0.79	2.02
80	<i>Kalanchoe pinnata</i> L.	1	100	1.08	0.86	1.19	3.06
81	<i>Kalanchoe marnieriana</i> H. Jacobsen	0.33	33.33	0.31	0.29	0.39	1.01
82	<i>Lantana camara</i> L.	1	100	0.53	0.87	1.19	3.06
83	<i>Lawsonia inermis</i> L.	0.66	66.66	4.84	0.57	0.79	2.02
84	<i>Ludwigia parviflora</i> L.	0.33	33.33	1.61	0.29	0.39	1.01
85	<i>Lycopersicon esculentum</i> Mill.	0.33	33.33	0.62	0.29	0.39	1.01
86	<i>Malvastrum coromandelianum</i> (L.) Garcke	0.66	66.66	0.01	0.57	0.79	2.02
87	<i>Mangifera indica</i> L.	1	100	17.2	0.87	1.19	3.06
88	<i>Manihot esculenta</i> Crantz	0.66	66.66	1.4	0.57	0.79	2.02
89	<i>Manilkara zapota</i> (L.) P. Royen	0.66	66.66	18.63	0.57	0.79	2.02
90	<i>Mirabilis jalapa</i> L.	0.66	66.66	0.11	0.57	0.79	2.02
91	<i>Morinda tinctoria</i> Roxb.	0.66	66.66	4.84	0.57	0.79	2.02
92	<i>Moringa oleifera</i> Lam.	1	100	19.62	0.87	1.19	3.06
93	<i>Morus rubra</i> L.	0.66	66.66	5.35	0.57	0.79	2.02
94	<i>Muntingia calabura</i> L.	0.66	66.66	10.16	0.57	0.79	2.02
95	<i>Murraya koenigii</i> (L.) Sprengel	0.66	66.66	3.26	0.57	0.79	2.02
96	<i>Musa paradisiaca</i> L.	1	100	14.08	0.87	1.19	3.06
97	<i>Ocimum sanctum</i> L.	1	100	0.2	0.87	1.19	3.06
98	<i>Opuntia cochenillifera</i> (L.) Mill.	0.33	33.33	2.23	0.29	0.39	1.01
99	<i>Osteospermum ecklonis</i> (DC.) Norl.	0.66	66.66	0.11	0.57	0.79	2.02
100	<i>Pandanus amaryllifolius</i> Roxb.	0.66	66.66	2.32	0.57	0.79	2.02
101	<i>Parthenium hysterophorus</i> L.	0.66	66.66	0.03	0.57	0.79	2.02
102	<i>Petalium murex</i> L.	0.33	33.33	0.11	0.29	0.39	1.01
103	<i>Pedilanthus tithymaloides</i> L.	1	100	0.38	0.87	1.19	3.06
104	<i>Pereskia bleo</i> (Kunth) Dc.	0.33	33.33	1.54	0.29	0.39	1.01
105	<i>Petrea volubilis</i> L.	0.33	33.33	1.03	0.29	0.39	1.01
106	<i>Phoenix pusilla</i> Roxb.	0.33	33.33	66.95	0.29	0.39	1.01
107	<i>Phyllanthus amarus</i> L.	1	100	0.01	0.87	1.19	3.06
108	<i>Piper longum</i> L.	0.33	33.33	0.13	0.29	0.39	1.01
109	<i>Pithecellobium dulce</i> (Roxb) Benth	0.33	33.33	9.98	0.29	0.39	1.01
110	<i>Plumbago zeylanica</i> L.	0.66	66.66	0.11	0.57	0.79	2.02
111	<i>Plumeria pudica</i> Jacq.	0.33	33.33	0.62	0.29	0.39	1.01
112	<i>Polyscias balfouriana</i> (Andre) L.H. Baily.	0.66	66.66	1.61	0.57	0.79	2.02
113	<i>Polyscias paniculata</i> (DC.) Barker	0.33	33.33	1.08	0.29	0.39	1.01
114	<i>Polyscias scutellaria</i> (Burm. f) Fosberg.	0.33	33.33	1.08	0.29	0.39	1.01
115	<i>Pongamia pinnata</i> (L.) Panigahi	0.33	33.33	12.84	0.29	0.39	1.01
116	<i>Portulaca grandiflora</i> Hook.	1	100	0	0.87	1.19	3.06
117	<i>Portulaca oleracea</i> L.	0.66	66.66	0.07	0.57	0.79	2.02
118	<i>Prosopis juliflora</i> (SW.)DC	0.66	66.66	13.66	0.57	0.79	2.02
119	<i>Prunus avium</i> (L)	0.33	33.33	1.08	0.29	0.39	1.01
120	<i>Pseuderanthemum carruthersii</i> (seem.) Guillaumin	1	100	0.13	0.89	1.19	3.06
121	<i>Pseuderanthemum reticulatum</i> L.	0.66	66.66	0.2	0.57	0.79	2.02
122	<i>Psidium guajava</i> L.	1	100	3.68	0.87	1.19	3.06
123	<i>Punica granatum</i> L.	1	100	1.91	0.87	1.19	3.06
124	<i>Quisqualis indica</i> L.	0.66	66.66	1.21	0.57	0.79	2.02
125	<i>Ricinus communis</i> L.	0.33	33.33	2.67	0.29	0.39	1.01
126	<i>Rosa</i> sp.	1	100	0.15	0.87	1.19	3.06
127	<i>Saccharum officinarum</i> L.	0.33	33.33	2.23	0.29	0.39	1.01
128	<i>Sansevieria trifasciata</i> prain.	0.33	33.33	29.35	0.29	0.39	1.01

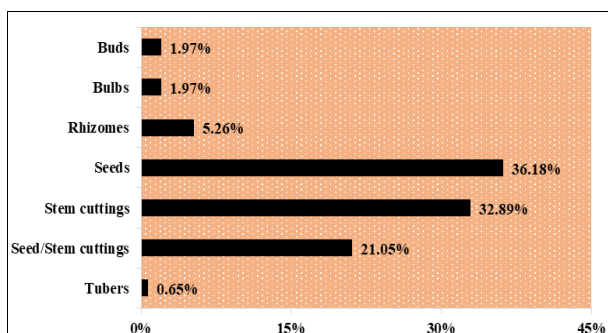
129	<i>Santalum album</i> Linn.	0.66	66.66	12.04	0.29	0.39	1.01
130	<i>Sida acuta</i> Burm. f.	0.66	66.66	0.01	0.57	0.79	2.02
131	<i>Solanum melongena</i> L.	0.33	33.33	1.08	0.57	0.79	2.02
132	<i>Solanum surattense</i> Burm f.	0.33	33.33	0.06	0.29	0.39	1.01
133	<i>Solanum torvum</i> Sw.	0.66	66.66	0.86	0.29	0.79	2.02
134	<i>Spermacoce hispida</i> L.	0.66	66.66	0.07	0.57	0.79	2.02
135	<i>Tabernaemontana divaricata</i> R.Br.ex Roem.& Schult	0.66	66.66	1.21	0.57	0.79	2.02
136	<i>Tagetes erecta</i> L.	0.66	66.66	0.11	0.57	0.79	2.02
137	<i>Talinum portulacifolium</i> (forssk.) Asch. ex. Schweinf.	1	100	1.54	0.87	1.19	3.06
138	<i>Tamarindus indica</i> L.	0.66	66.66	152.04	0.57	0.79	2.02
139	<i>Tecoma stans</i> (L.) Juss ex kunth.	1	100	3.68	0.87	1.19	3.06
140	<i>Tecomaria capensis</i> (Thunb.) lindl.	1	100	0.76	0.87	1.19	3.06
141	<i>Tectona grandis</i> L.	1	100	48.57	0.29	0.39	1.01
142	<i>Thespesia populnea</i> (L.) sol.ex Correa.	1	100	30.274	0.87	1.19	3.06
143	<i>Thevetia peruviana</i> (pers.) k. schum.	0.33	33.33	5.09	0.29	0.39	1.01
144	<i>Tithonia diversifolia</i> (Hemsl.) A. Gray.	0.33	33.33	0.62	0.29	0.39	1.01
145	<i>Tradescantia spathacea</i> Sw.	0.33	33.33	2.23	0.29	0.39	1.01
146	<i>Vitex negundo</i> L.	0.33	33.33	7.185	0.29	0.39	1.01
147	<i>Wedelia chinensis</i> (Osbeck) Merr.	0.33	33.33	0.134	0.29	0.39	1.01
148	<i>Xanthium strumarium</i> L.	0.66	66.66	0.028	0.57	0.79	2.02
149	<i>Zephyranthes rosea</i> Lindl.	0.66	66.66	0.86	0.57	0.79	2.02
150	<i>Zingiber officinale</i> Roscoe.	0.33	33.33	1.27	0.29	0.39	1.01
151	<i>Zinnia elegans</i> Jacq.	0.66	66.66	0.25	0.57	0.79	2.02
152	<i>Ziziphus jujuba</i> Mill.	0.33	33.33	0.134	0.29	0.39	1.01

**Table 3:** Propagation Method of the Plants in the Study Area

S. No	Mode of propagation	Number of Species
1	Buds	3
2	Bulbs	3
3	Rhizomes	8
4	Seeds	55
5	Stem cuttings	50
6	Seed/Stem cuttings	32
7	Tubers	1

Although this quantitative phytosociological studies indicate us the vegetation of study area is facing heavy threat of loss due to the extensive lopping of tress, overgrazing, urbanization, anthropogenic and some other biotic interference.

The different types of propagation methods of the plants from the study area was tabulated in Table.3. It was found that mode of propagation majorly done by seed propagation (36.18%) and stem cutting method (32.89%). Although either seed or stem cutting mode was adopted for 21.05% plants from the study area (Fig.6). Further rest of the plants from the study area were propagated using their different parts such as buds (1.97%), bulbs (1.97%), rhizomes (5.26%) and tubers (0.65%). In this study environmental conditions and propagules maturity *etc* were found key factors for their regeneration



**Fig 6:** Bar Diagram Showing Mode of Propagation of Plants in the Study Area

Maximum amount of frequency and density were recorded in the study area shows that the plants have comparatively higher frequency and density, consequently higher degree on dispersion and numerical strength. It seems, in such natural communities, that stability appears to depend on the balance between the stability and variability of the environment. Conservation of ecosystem can be achieved with the help of existing knowledge and surveying the disturbance of investigating and inventorying vegetation richness of the area. The parameters such as causes of fire, anthropogenic intervention, existing vegetation richness and socio-economic pressure will play major role for predicting the future floristic diversity conservation.

**Conclusion**

It can be concluded that plant sociological characters including frequency, density, abundance and Importance value Index were determined by both natural and biotic stress predominant at the study area. Phytosociological studies plays an important role in biodiversity with references to density, frequency, dominance and their relative values distribution could well act as indicators of anthropogenic disturbances. This type of studies may help to understand the risks that are involved with the rural vegetation and would help in formulation of new conservation policies. This studies can also enrich the traditionally valued natural systems and will help in management and conservation of biodiversity.

**Conflict of Interest**

We declare that we have no conflict of interest.

**References**

- Meijard E, Sheil D, Nasi R, Augeri D, Rosenbaum B, Iskandar D, Setyawati T *et al.* Life after logging: reconciling wildlife conservation and production forestry in Indonesian Borneo. Bogor, Indonesia: Center for International Forestry Research, 2005.

2. Asner GP, Broadbent EN, Oliveira PJC, Keller M, Knapp DE, Silva JNM. Condition and fate of logged forests in the Brazilian Amazon. *Proc. Nat. Acad. Sci. USA*,2006:103:12947-12950.
3. Cronin R, Pandya A. Eds, exploiting natural resources, growth, instability, and conflict in the Middle East and Asia. The Henry L. Stimson Center, 2009.
4. Kharkwal G. Qualitative analysis of tree species in evergreen forests of Kumaun Himalaya, Uttarakhand, India. *African Journal of Plant Science*,2009:3(3):049-052.
5. West NE. Biodiversity of rangelands. *J Range Management*,1993:46:2-13.
6. Nayar MP. The vegetation of Kanyakumari district. *Bull Bot Surv India*,1959:1:122-126.
7. Lawrence CA. The vegetation of Kanyakumari district (Cape Comorin). *J Bombay Nat Hist Soc*,1960:57:184-195.
8. Henry AN, Swaminathan M. Observation on the vegetation of Kanyakumari district, Tamil Nadu. *Bull Bot Surv India*,1981:23:135-139.
9. Sundarapandian SM, Swamy PS. Plant biodiversity at low elevation evergreen and moist deciduous forests at Kodayar (W. Ghats, India). *Int J Eco Env Sci*,1997:23:363-379.
10. Raj ADS, Sukumaran S. Observations on the sacred groves of south Tamil Nadu. In: Abstracts of National Symposium on Natural Resources Management Systems, St. Joseph College, Thiruchirapalli, Tamil Nadu, 1997.
11. Williams PG. Studies on medicinal plants of Trivandrum district. MPhil Thesis. Department of Botany, Scott Christian College, Nagercoil, India, 2004.
12. Kingston C, Mishra BP, Nisha BS, Jeeva S, Livingstone C, Laloo RC. Diversity and distribution of economically important plants in traditional homegardens of Kanyakumari district, Tamil Nadu, southern peninsular India. *J Nat Con*,2006:18:41-54.
13. Sheeba J Irwin. Biology, Population and Mapping of Selected Endemic and Threatened Trees of Western Ghats of Kanyakumari District, Tamil Nadu, India. Ph.D Thesis. University of Madras, India, 2006.
14. Sukumaran S, Jeeva S, Raj ADS, Kannan D. Floristic diversity, conservation status and economic value of miniature sacred groves in Kanyakumari district, Tamilnadu, Southern Peninsular India, Turk. *J. Bot*,2008:32:185-199.
15. Sukumaran S, Soloman Jeeva. Angiosperm flora from wetlands of Kanyakumari district, Tamilnadu, India. *Check list*,2011:7(4):486-495.
16. Sukumaran S, Parthipan B. Vascular plant diversity of Udayagiri fort, Kanyakumari district, Tamilnadu, India. *Biosci. Dis*,2014:5(2):204-217.
17. Malar Vizhi M, Lohidas J. Studies on wild edible plants consumed by the tribes of Kanyakumari wild life sanctuary, India, *Plant Archives*,2020:20(2):6503-6509.
18. Bole PV, Pathak JM. The Flora of Saurashtra (Asteraceae to poaceae) BSI. Calcutta, 1988, 2-3.
19. Hooker JD. The flora of British India British India. Reeve and Co. Ltd, London, 1872-1897.
20. Gamble JS, Fischer CEC. Flora of presidency of Madras - vol 1-3, Adlard and Son Ltd., London, 1921-1935, 1-2017.
21. Singh MP, Singh E. Biodiversity and Phytosociological Analysis of Plants around the Municipal Drains in Jaipur, World Academy of Science, Engineering and Technology,2010:4:01-28.
22. Rampilla V, Khasim S, Mahammad Kakumanu B. Floristic diversity and Phyto-sociological studies of Indrakiladri Sacred Grove in Krishna district, Andhra Pradesh, India. *Journal of Pharmacy and Biological Sciences*,2015:10:61-75
23. Deepa MR, Udayan PS, Anilkumar KA. Taxonomical and phytosociological studies on Chithalikavu A sacred grove, Thrissur district, Kerala. *Tropical Plant Research*,2017:4(1):20-30.
24. Haftay Hailu. Analysis of Vegetation Phytosociological Characteristics and Soil Physico-Chemical Conditions in Harishin Rangelands of Eastern Ethiopia. *Land*,2017:6(4):1-17.
25. Amzad Basha Kolar, Ghouse Basha. Survey of Medicinal Plants of Pachamalai Hills, A Part of Eastern Ghats, Tamil Nadu. *International Journal of Current Research*,2013:5(12):3923-3929.
26. Amzad Basha Kolar, Palanivel S, M Sheik Noor Mohamed, S Sheik Mohamed, M Shareef Khan *et al.* Floristic study on Angiosperms surrounding the Medavakkam Lake, Chengalpattu District, Tamil Nadu, India,2021:21(1):1953-1962.
27. Bazzaz FA. *Plants in Changing Environments: Linking Physiological, Population, and Community Ecology*. Cambridge, UK: Cambridge University Press, 1996.
28. Chapin FS III, Zavaleta V Eviner, Naylor R, Vitousek P, H Reynolds, Hooper D, Lavorel *Set al.* Consequences of changing biodiversity. *Nature*,2000:405:234-42.
29. Hooper DU, FS Chapin III, Ewel JJ, Hector A, Inchausti P, Lavorel S *et al.* Effects of biodiversity on ecosystem functioning: a consensus of current knowledge. *Ecol Monogr*,2005:75:3-35.
30. Karthigeyan Kaliyamurthy, Ilangovan Kumaraswamy Wilson Arisdason. An Assessment of Angiosperm Diversity of Adyar Estuary, Chennai – A Highly Degraded Estuarine Ecosystem, Tamil Nadu, India. *Check List*,2013:9(5):920-940.
31. Muralidharan R. Angiosperm Diversity, Ethnobotany and Vegetational Analysis of A Sacred Forest Near Gingee, Tamil Nadu, India. Ph.D Thesis. University of Madras, Chennai, India, 2014.
32. Keya MA, AHM Mahbubur Rahman. Angiosperm Diversity at the Village Sabgram of Bogra, Bangladesh with Emphasis on Medicinal Plants. *American Journal of Plant Biology*,2017:2(1):25-34.
33. Wilsey B, Stirling G. Species richness and evenness respond in a different manner to propagule density in developing prairie microcosm communities. *Plant Ecol*,2007:190:259-273.