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Plant Biodiversity Inventory and Life-form Spectrum Analysis in Vanathirayapattinam Forest, Ariyalur District, Tamilnadu

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Abstract

The study of the plant species Vanathirayapattinam forest of Ariyalur district, TamilNadu was explored for the floristic studies and life form spectrum. It covers an area 8 ha. Totally 112 Angiosprmic plant species represented by 91 genera belonging to 47 families and the habit wise distribution of plants species dominance of Herb 33 (29.46%) followed by Shrub 29 Species (25.89%), Trees 26 Species (23.21%), Climber 15 Species (13.39%), Straggler 7 Species (6.25%) and Twiner, Vine each 1 Species (0.89%) were recorded. The life form spectrum revealed the dominance of Phanerophytes (53.57%) and these were followed by the Therophytes (38.39%), Chameophytes (4.46%), Cryprophytes (2.68%), and Hemicryptophytes (0.89%). Phanerophytes were found higher than the normal biological spectrum which indicated the study area prevailing environment. Some rare plants have confined of these forests. Soil Physico-chemical parameter was analysed.

Key words: Biodiversity, Life form, Floristic, Spectrum.

INTRODUCTION

Biological diversity encompasses all species of plants, animals, and microorganisms and the ecosystem and ecological processes of which they are part. India is well known for its native plant wealth and has received the attention of both explorers and traders in the remote past. The detailed and systematic measurements of forest structure and floristic are necessary for the study of forest dynamics, plant-animal interactions, and nutrient cycling (Reddy Sudhakar *et al.*, 2009). As a life support system, forests are the most important component of the earth. The rich Biodiversity has been instrumental in providing humanity with food security, health care goods, ecosystem function, and stability (Pitchairamu *et al*, 2008). Tropical forests constitute the most diverse plant communities on the earth. During the last few decades, for one or the other reasons, the biodiversity of these forests are disappearing at an alarming rate. To assure the needs and hunger of the people, many important plants are threatened and becoming rare, even some are on the

threshold of extinction. The difficulty with the chronic form of forest interruption is that plants or ecosystems often do not get time to recover adequately because the human onslaught never stops. Therefore it is very urgent to stop exploitation and develop an appropriate strategy for conservation and sustainable utilization of plant resources.

Worldwide important biological diversity territories are called hot spot territories and India is one of the hot spot territories of the world having rich vegetation with a wide variety of plants. Biodiversity is the degree of nature variety including both the number and frequency of ecosystem, species genes assemblage (McNeely, 1988), or the variability among the living organisms from all foundation counting, interalia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this comprises diversity within species, between species and ecosystem (Agarwal, 2002).

Plant biodiversity is a valuable endowment of nature upon which mankind has always been dependent. The diverse nutritional values of fruits and seeds enable a species to get the variety of the chemical that is necessary for its diet and hence to graze without exhausting the population of a specified species (Trivedi, 2000). The studies of biodiversity have now assumed greater significance as ecologists try seriously to document global biodiversity in the face of unprecedented perturbations, habit loss, and extinction rates. To understand and assess the richness of biodiversity, a taxonomic study of the flora of forests is very much essential. Floristic surveys are the only means by which we can reach this goal. The floristic studies are considered the backbone of the assessment of phytodiversity, conservation management, and sustainable utilization (Jayanthi and Rajendran, 2013). Vegetation is an important part of an ecosystem that interprets the effects of the total environment (Billing, 1952). The vegetation complex fluctuates from season to season in a cycle over the years in a successional way and the fluctuations suggest a response by each species population to widespread heat, moisture, and light as adapted by the vegetation itself.

In forest ecosystem, the plant component is more important than the other living component of the system for the determination of its structure and function (Richards 1996). Raunkiaer (1934) proposed a life form system for the description of vegetation on physiognomic basis. This system is ecologically oriented and based primarily on the position of perennating organs or buds from which new shoots or foliage developed after an unfavorable season. He described communities of different climatic zones on earth on the basis of life form (the sum of adaptation of the plant to climate) composition.

MATERIAL AND METHODS

1.Floristic analysis

1.1Study Area

The study area Vanathirayapattinam forest, located at Udayarpalayam Taluk, Ariyalur district, TamilNadu. The district boundaries are North of Cuddalour. West of Perambalur, East of Nagappattinam, and south and east of Thanjavur district. It is geographical limit is 11.1711 º N Latitude, 79.3583ºE longitude, with elevation ranging 83m altitude above mean sea level. The temperature ranges from 33-40ºC during summer and 17ºC to 30ºC during winter. Annual rainfall 954 mm.

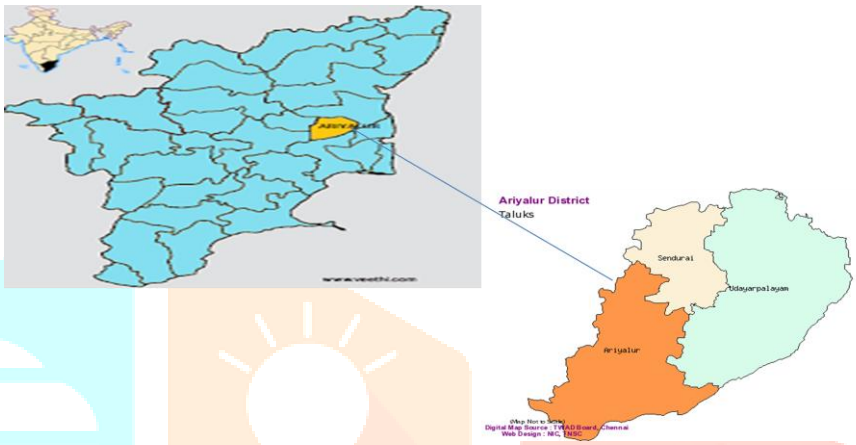

Figure 1 study area map Vanathirayapattinam forest, located at Udayarpalayam Taluk, Ariyalur district

1.2 Data collection

The floristic vegetation of the study area stands as a tropical dry evergreen forest with local variations. Field trips to various parts of the selected area undertaken to collect the specimens and information's to be used for future reference. The segments were visited repeatedly. The collected specimens were identified and systematic enumeration was made with available monographs, relevant works of literature and taxonomic revisions (Gamble 1935; Mathew, 1982). All the species were assigned a suitable life form and a biological spectrum was prepared. This was compared with the (Raunkiaer 1934) normal biological spectrums. The soil samples were analyzed for their physicochemical properties such as pH, electrical conductivity (EC), salinity, macro, and micronutrients following the standard protocols of the Tamil Nadu government department of agriculture, Ariyalur, India.

RESULTS AND DISCUSSION

1.Floristic composition

Floristic diversity, as explained by Ali *et al*. (2016), is the amount of all plants present in any geographic area, both wild and cultivated, which reflects the prevailing climatic conditions, edaphic characteristics, anthropogenic pressure, and other natural stresses. A total of 112 species of vascular plants belonging to 91 genera distributed among 47 families were recorded during a detailed floristic inventory from March 2020 to October 2020 (Table-1&Fig-2). Sridhar Reddy and Parthasarathy 2006 reported 77 species in 61 genera and 30 families. Among the families, Mimosaceae was most dominant comprising 2

genera and 7 species followed by Acanthaceae represented by 6 Species. Lamiaceae, Convolvulaceae, and Malvaceae represented by 5 Species., Poaceae, Moraceae, and Asclepiadaceae, represented by 4 Species. Present findings are comparable with other studies in sacred groves of Tamilnadu and other regions of India. In Tamilnadu, several studies with respect to floristic inventory were reported includes 113 species in 100 genera and 54 families from Pudukkottai (Dhanasekar *et al.*, 2018), 113 species in 102 genera, and 51 families from Perambalur (Rajkumar *et al.*, 2019), 141 angiosperms species 105 genera and 49 families from Ariyalur (Rajkumar *et al.*, 2020).

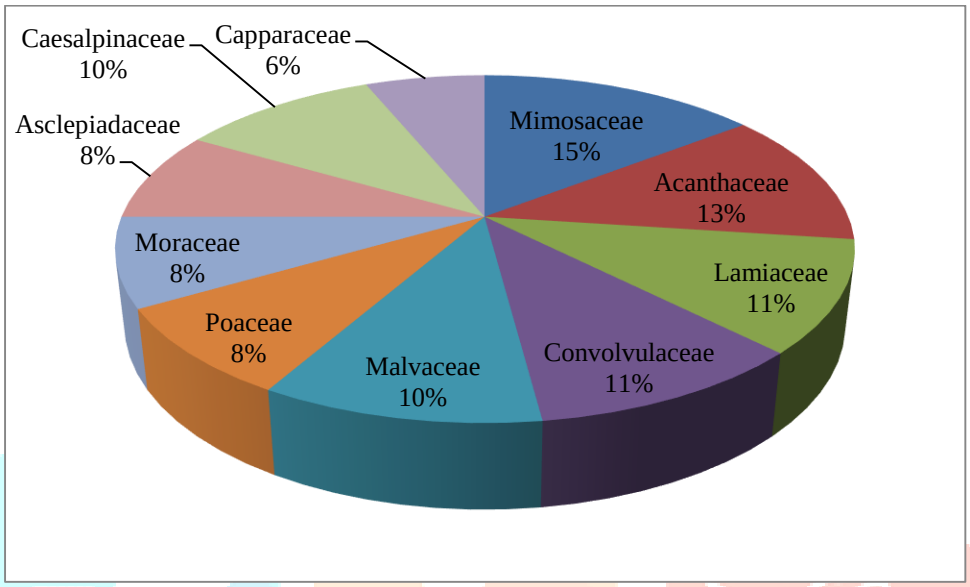

Figure 2 Distribution of dominant plant families in the study area

Table 1 Floristic composition, Habit and life form of the species in study area.

S. No	Species Name	Family	Habit	Life Form
1	*Abrus precatorius* L.	Fabaceae	Straggler	Ph*
2	*Abutilon indicum* (L.) Sweet	Malvaceae	Shrub	Ph
3	*Acacia chundra* (Rottler) Willd.	Mimosaceae	Tree	Ph
4	*Acacia leucophloea* (Roxb.) Willd.	Mimosaceae	Tree	Ph
5	*Acacia nilotica* (L.) Willd. ex Del.	Mimosaceae	Tree	Ph
6	*Acacia pinnata* L.	Mimosaceae	Straggler	Ph
7	*Acacia torta* L.	Mimosaceae	Tree	Ph
8	*Acalypha indica* L.	Euphorbiaceae	Shrub	Th*
9	*Achyranthes aspera* L.	Amaranthaceae	Herb	Th
10	*Adhatoda zeylanica* Medic.	Acanthaceae	Shrub	Ph
11	*Aegle marmelos* (L.) Corr.	Rutaceae	Tree	Ph
12	*Aerva lanata* (L.) Juss.	Amaranthaceae	Herb	Th
13	*Alangium salvifolium* (L.f.) Wang	Alanginaceae	Tree	Ph
14	*Albizia amara* (Roxb.) Boivin	Mimosaceae	Tree	Ph
15	*Albizia lebbeck* Benth.	Mimosaceae	Tree	Ph
16	*Alternanthera sessilis* (L.) R.Br.	Amaranthaceae	Herb	Ch*
17	*Ammannia baccifera* L.	Lythraceae	Herb	Th
18	*Andrographis paniculata* Nees	Acanthaceae	Shrub	Th
19	*Anisomeles malabarica* R.Br.	Lamiaceae	Shrub	Th
20	*Argemone mexicana* L.	Papavaraceae	Herb	Th
21	*Argyreia cymosa* (Roxb.) Sw.	Convolvulaceae	Straggler	Ph
22	*Aristolochia indica* L.	Aristolochiaceae	Twiner	Th
23	*Artocarpus heterophyllus* Lam.	Moraceae	Tree	Ph
24	*Asparagus racemosus* Willd.	Liliaceae	Climber	Ph
25	*Azadirachta indica* A. Juss.	Meliaceae	Tree	Ph
26	*Bambusa arundinacea* (Retz.) Roxb.	Poaceae	Tree	Ph
27	*Barleria prionitis* L.	Acanthaceae	Shrub	Ph
28	*Boerhaavia diffusa* L.	Nyctaginaceae	Herb	He*
29	*Cadaba fruticosa* (L.) Druce	Capparaceae	Shrub	Ph
30	*Calotropis gigantea*, R.Br. ex Ait.	Asclepiadaceae	Shrub	Ph
31	*Canthium coromandelicum* N. Burm	Rubiaceae	Shrub	Ph
32	*Capparis sepiaria* L.	Capparaceae	Shrub	Ph
33	*Capparis zeylanica* L.	Capparaceae	Shrub	Ph
34	*Cardiospermum halicacabum* L.	Sapindaceae	Vine	Ph
35	*Carrissa carandas* L. Mantiss.	Apocynaceae	Shrub	Ph
36	*Cassia auriculata* L.	Caesalpinaceae	Shrub	Ph
37	*Cassia fistula* L.	Caesalpiniaceae	Tree	Ph
38	*Cassia occidentalis* L	Caesalpinaceae	Shrub	Ph
39	*Cassia tora* L.	Caesalpinaceae	Shrub	Th
40	*Casuarina equisetifolia* L.	Casuarinaceae	Tree	Ph
41	*Chloris barbata* Sw.	Poaceae	Herb	Th
42	*Chloris virgata* L.	Poaceae	Herb	Th
43	*Cissus quadrangularis* L.	Vitaceae	Climber	Ph
44	*Cleome gynandra* L.	Cleomaceae	Herb	Th

45	*Cleome viscosa* L.	Cleomaceae	Herb	Th
46	*Clitoria ternatea* L.	Fabaceae	Climber	Th
47	*Coccinia grandis* (L.) Voigt.	Cuccurbitaceae	Climber	Th
48	*Cocculus hirsutus* (L.) Diels	Menispermaceae	Climber	Ph
49	*Commelina benghalensis* L.	Commelinaceae	Herb	Th
50	*Croton bonplandianus* Baillon	Euphorbiaceae	Shrub	Th
51	*Cuscuta reflexa* Roxb.	Cuscutaceae	Climber	Ph
52	*Cynodon dactylon* (L.) Pers.	Poaceae	Herb	Ch*
53	*Datura metel* L. Solanaceae	Solanaceae	Shrub	Ph
54	*Dodonaea viscosa* L.	Sapindaceae	Shrub	Ph
55	*Eclipta alba* (L.) Hassk.	Asteraceae	Herb	Th
56	*Eucalyptus globulus* Labill	Myrtaceae	Tree	Ph
57	*Euphorbia hirta* L.	Euphorbiaceae	Herb	Th
58	*Evolvulus alsinoides* (L.) L.	Convolvulaceae	Herb	Ch
59	*Ficus benghalensis* L.	Moraceae	Tree	Ph
60	*Ficus racemosa* L.	Moraceae	Tree	Ph
61	*Ficus religiosa* L.	Moraceae	Tree	Ph
62	*Gloriosa superba* L.	Liliaceae	Climber	Cr*
63	*Gymnema sylvestre* R.Br.	Asclepiadaceae	Straggler	Ph
64	*Heliotropium indicum* L.	Boraginaceae	Herb	Th
65	*Hemidesmus indicus* R.Br.	Periplocaceae	Straggler	Ph
66	*Hibiscus ros-sinensis* L.	Malvaceae	Shrub	Ph
67	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Shrub	Th
68	*Ipomoea nil* (L.) Roth	Convolvulaceae	Climber	Th
69	*Ipomoea obscura* (L.) Ker-Gawl.	Convolvulaceae	Climber	Th
70	*Ipomoea pes-tigridis* L.	Convolvulaceae	Climber	Th
71	*Jatropha glandulifera* Roxb.	Euphorbiaceae	Shrub	Ph
72	*Jatropha gossypifolia* L.	Euphorbiaceae	Shrub	Ph
73	*Justicia diffusa* willd.	Acanthaceae	Herb	Th
74	*Lannea coromandelica* Houttuyn	Anacardiaceae	Tree	Ph
75	*Lantana camara* L.	Verbenaceae	Shrub	Ph
76	*Leucas aspera* Spreng.	Lamiaceae	Herb	Th
77	*Mangifera indica* L.	Anacardiaceae	Tree	Ph
78	*Melia azadirachta* L.	Meliaceae	Tree	Ph
79	*Mollugo pentaphylla* L.	Aizoaceae	Herb	Th
80	*Momordica charantia* L.	Cuccurbitaceae	Tree	Th
81	*Ocimum americanum* L.	Lamiaceae	Herb	Th
82	*Ocimum tenuiflorum* L.	Lamiaceae	Herb	Th
83	*Oldenlandia umbellata*	Rubiaceae	Climber	Th
84	*Opuntia elatior* (Willd.) Miller	Cactaceae	Shrub	Ph
85	*Passiflora foetida* L.	Passifloraceae	Climber	Th
86	*Pedalium murex* L.	Pedaliaceae	Herb	Ch
87	*Pentatropis capensis* (L.f.) Bullock	Asclepiadaceae	Straggler	Ph
88	*Phyllaanthus amarus* schum&Thonn	Euphorbiaceae	Herb	Th
89	*Physalis minima* L.	Solanaceae	Herb	Th
90	*Polyalthia longifolia* (Sonner.) Thw.	Annonaceae	Tree	Ph
91	*Polycarpaea aurea* Wight & Arn.	Caryophyllaceae	Herb	Th
92	*Polygala chinensis* L.	Polygalaceae	Herb	Th
93	*Ricinus communis* L.	Euphorbiaceae	Shrub	Th

94	*Ruellia prostrata* Poir	Acanthaceae	Herb	Cr
95	*Ruellia tuberosa* L.	Acanthaceae	Herb	Cr
96	*Sida acuta* Burm.	Malvaceae	Shrub	Ph
97	*Sida cordata* (N.Burman) Borssum	Malvaceae	Shrub	Th
98	*Sida cordifolia* L.	Malvaceae	Shrub	Th
99	*Solanum trilobatum* L.	Solanaceae	Climber	Th
100	*Sphaeranthus indicus* L.	Asteraceae	Herb	Th
101	*Syzygium gardneri* Thwaites	Myrtaceae	Tree	Th
102	*Tamarindus indica* L.	Caesalpinaceae	Tree	Ph
103	*Tectona grandis* L.f.	Verbenaceae	Tree	Ph
104	*Tephrosia purpurea* (L.) Pers.	Fabaceae	Herb	Ph
105	*Tinospora cordifolia* (Willd.) Hook.	Menispermaceae	Climber	Ph
106	*Tribulus terrestris* L.	Zygophyllaceae	Herb	Th
107	*Tridax procumbens* L.	Asteraceae	Herb	Ch
108	*Tylophora indica (*Burm. f.) Merr.	Asclepiadaceae	Climber	Ph
109	*Vernonia indica* C. B. Clarke	Asteraceae	Herb	Ph
110	*Vitex negundo* L.	Verbenaceae	Shrub	Ph
111	*Ziziphus mauritiana* Lam.	Rhmnaceae	Tree	Ph
112	*Ziziphus oenoplia* (L.) Mill.	Rhmnaceae	Straggler	Ph

(*Th-Therophytes, *Ph-Phanerophytes, *Ch-Chameophytes,*Cr-Cryptophytes,*He-Hemicryptophytes)

Based on the habit classification of the 112 plants, the maximum numbers of species were Herbs 33 species, followed by Shrubs 29 Species, Trees 26 species, Climbers 15 species, Straggler 7 species, twiner and vine 1 species each. (Table 2 and Figure 3) This study shows that herbaceous plants (ephemeral plants) are dominating the forest. This is almost certainly due to the semi-arid environment and erratic rainfall. Further, the scrubby plant species (small trees and shrubs) can be experimental as the dominant perennial vegetation of the area.

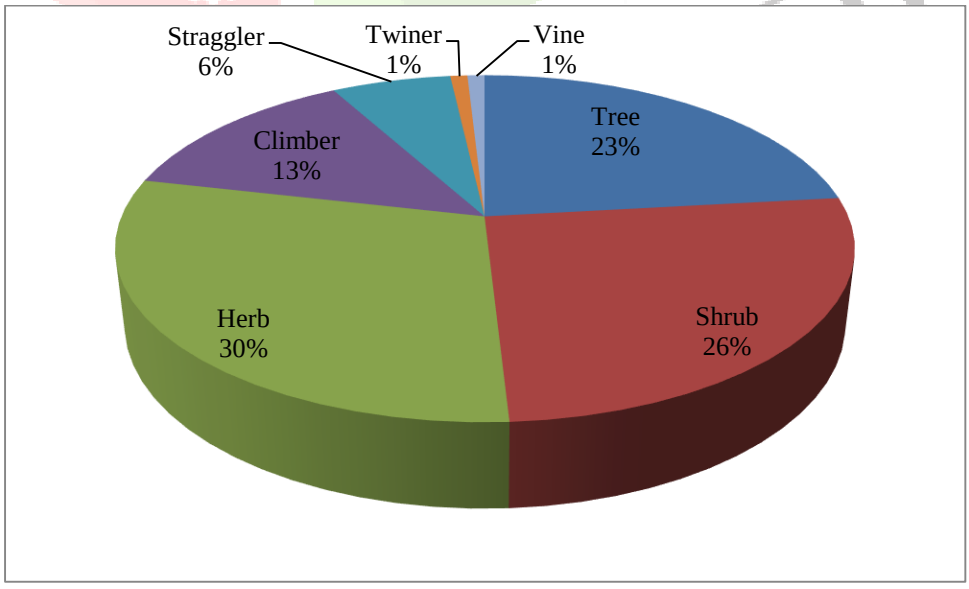

Figure 3 Percentage of plants species in Vanathirayapattinam forest Ariyalur District.

Table 2 Composition of Habit Wise distribution of plants species in Vanathirayapattinam forest Ariyalur District.

S.No	Habit	No. of Species	Percentage (%)
1	Tree	26	23.21
2	Shrub	29	25.89
3	Herb	33	29.46
4	Climber	15	13.39
5	Straggler	07	06.25
6	Twiner	01	00.89
7	Vine	01	00.89

1.2 Life form spectrum

A life-form spectrum indicates climatic and human disturbances in a geographic area and is characterized by plant adaptation to certain ecological conditions (Cain and Castro 1959; Durrani et al., 2010).In the biological spectrum, the trend of (Raunkiaer, 1934) life forms present study sites are observed as Phanerophytes 60 species (53.57%) > Therophytes 43 species (38.39%) > Chameophytes 6 species (4.46%) > Cryptophytes 3 species (2.69%) Hemicryptophytes 1 species (0.89%) >, (Table-3 & Figure-4). Awasthi *et al*, (2007) have also the reported floristic diversity of Bandhavgarh national park, enumerating 47 plant species. Inamati *et al*, (2007) have reported 43 families represented by 130 species across four altitudinal zones in Devimane, (Western Ghats) Karnataka. In the present study majority of the plant species is dicot than monocot. Thakur *et al*, (2009) reported 31 dicot and 1 monocot families distributed in 63 genera and 73 species of trees.

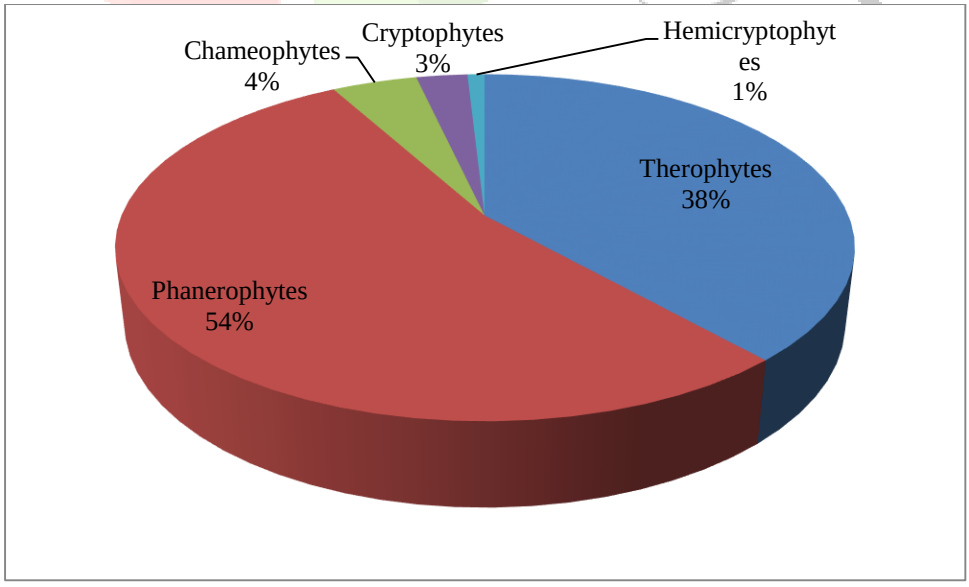

Figure 4. No. of species and percentage of different life form classes in Vanathirayapattinam Forest Ariyalur district

Table-3 Total number of species and percentage of different life form classes in Vanathirayapattinam forest Ariyalur district.

S. No	Life form classes	No. of species	Percentage (%)
1	Therophytes (Th)	43	38.39
2	Phanerophytes (Ph)	60	53.57
3	Chameophytes (Ch)	05	04.46
4	Cryptophytes (Cr)	03	02.68
5	Hemicryptophytes (He)	01	00.89

1.3 Soil Analysis

The soil of the study area was generally acidic in summer 5.12 and monsoon 6.7. The soil organic carbon content was highest in monsoon (0.96kg/acre) and low summer (0.48 kg/acre). The total soil nitrogen was maximum during monsoon (99.02 kg/acre) minimum in summer (66.0 kg/acre). The amount of exchangeable potassium was highest in monsoon (102.4kg/acre) and low in summer (67.5kg/acre). The maximum amount of available phosphorus was found in summer (8.0 kg/acre) and minimum in monsoon (1.32 kg/acre). The iron, manganese, zinc, copper, and electrical conductivity is being presented in table-3 & figure-5. Kiran *et al*, (2013) studied the physicochemical parameters of soil samples from Bhusawal (Jalgaon Dist.). The investigation was done for conductivity, pH, and also for potassium. The author found the pH of all seven samples out of eight in the alkaline range. The pH range of 6 to 8 is useful for the growth of plants. N, K, P compositions in soil were the main factors that determine the diversity and dominance of Cyanobacteria and also responsible for the plant diversity. So the finding proved each of the sacred groves maintained physical and chemical parameters which facilitate the growth of both Cyanobacterial and floral species (Vinoth *et al*. 2017). As defined by Joffe (1949), the soil is a natural body consisting of layers (horizons) of mineral constituents of uneven thicknesses, which differ from the close relative materials in their morphological, chemical, and mineralogical characteristics. Soil means a substrate for plant growth which performs many functions essential to life. In universal, nearly all plants grow by absorbing nutrients from the soil. The soil in this forest is of three types. The first one is 'Morrum' it is half decaying soil just under the upper surface. The second type of soil is the coarse soil mixed with clay and their type is the yellowish-brown soil. Soil organic carbon (SOC) plays an important role as a source of plant nutrients and maintaining soil reliability. Any land-use management that increases SOC by removing CO_2 from the atmosphere by store it in the soil, is termed carbon appropriation.

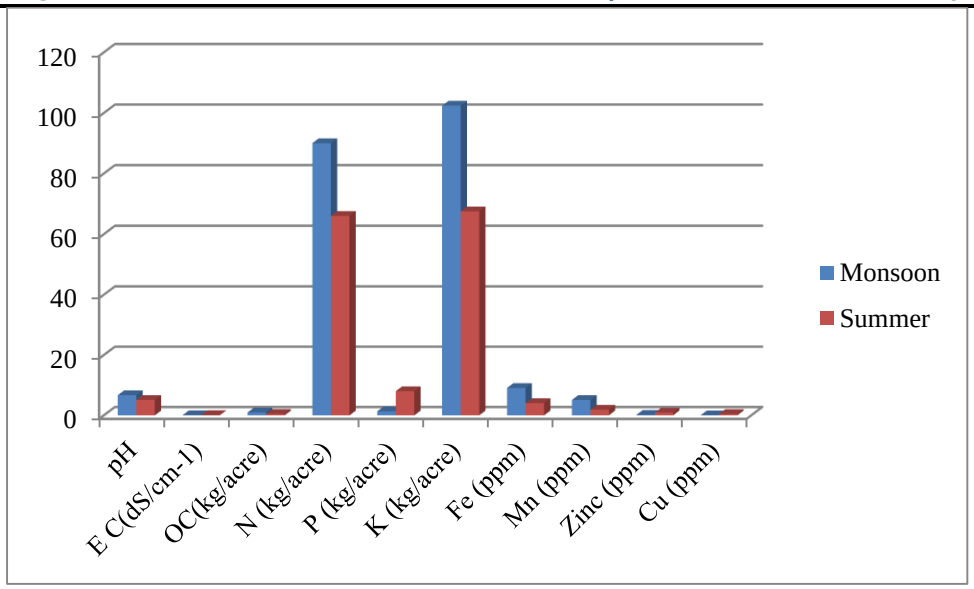

Figure 5. Physicochemical properties of soil samples in the study area.

Table-4 Physicochemical properties of soil samples in Vanathirayapattinam forest of Ariyalur district as summer and monsoon

S. No	Physicochemical properties	Monsoon	Summer
1.	pH	6.70	5.12
2.	Electrical conductivity (dS/cm^{-1})	0.06	0.09
3.	Organic carbon (kg/acre)	0.96	0.48
4.	Nitrogen (kg/acre)	90.02	66.00
5.	Phosphorous (kg/acre)	1.32	8.00
6.	Potassium (kg/acre)	102.40	67.50
7.	Iron (ppm)	9.09	4.05
8.	Manganese (ppm)	5.10	1.86
9.	Zinc (ppm)	0.16	0.90
10.	Copper (ppm)	0.02	0.45

CONCULSION

The present study deals with the floristic composition of flowering plants and life form spectrum analysis of Vanathirayapattinam forest is important as it is the native and endemic species of flora are conserved. Though there are many more life forms that need to be identified up to species level, the phanerophytes and therophytes dominate in all the parts. The biological spectrum reflects the variation of plants to the environment and key climate. Geographically widely separated plant communities can be very usefully compared with one another on the basis of the biological spectrum. Since life forms are related to the environment, the biological spectrum is also an indicator of the prevailing environment. Further study is needed to quantify the data and suggests plans for the conservation of the area. The primary aim of the present research is descriptive documentation of the first-hand information of the community structure of plant diversity and soil characteristics of the landmass of the forest.

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