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SURVEY OF MEDICINAL FLORA IN THE FOOTHILLS OF KALAKAD FOREST AREA, NEAR KALAKAD VILLAGE, TIRUNELVELI DISTRICT, TAMIL NADU INDIA.

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ABSTRACT

A survey was done to identify medicinally important plants used by local people in the foot hills of Kalakad Forest area, Kalakad village, Tirunelveli District, Tamil Nadu, India. A total of 159 medicinal plant species belongs to 54 families consists of 124 genera recorded in the study area. Out of 159 species, 157 are Angiosperms, 1 Pteridophytes and 1 Gymnosperms. About 12 plants comes under IUCN status of which 9least concern, 2 rare in south India and 1 endangered category. The dominant life form representing 65 species (40.88%) followed by herbs with 54 species (33.96%), trees with 28 species (17.61%), climbers with 10 species (6.29%) and lianas with 2 species (1.26%). The Euphorbiaceae family noted as dominant family with 12 species and 4 genera while 3 families with more number of genus and less number of species. Leaves of many medicinal plants used in maximum number of remedies (53 diseases; 50%) and is followed by whole plant and their products in 51 (48.11%) remedies, roots in 40 remedies and seeds in 23 remedies. A maximum of 130 medicinal plants (81.76%) was used as whole plants in 51 remedies while 101 medicinal plant species (63.52%) leaf and their products used to cure 50% (53 diseases) and 67 medicinal plant species (42.14%) used to cure about 40 diseases (37.74%) with roots and their products. Among the 106 diseases, recorded about 50 diseases treated with only one part of medicinal plants, 18 diseases cured with 3 parts of the medicinal plants, 16 remedies with 2 parts, 8 diseases with 4 parts, 6 diseases with 6 pars of medicinal plants, and 4 diseases with 5 or 7 parts of medicinal plants. Similarly, about 41 diseases cured with only one medicinal plant species (monotypic) while 16 diseases cured with 2 species, 12 diseases with 3 species, 7 diseases with 4 species, and remedies like cooling, purgatives, astringent, and skin problems were done with 10, 12, 20 and 26 species of medicinal plants, respectively. Most of the medicinal plants (116) recorded in the study area available though out the year whereas 27 species available during November to February, 12 species available from November to March and 4 species available from November to January.

Key words- Medicinal Plants Survey; Kalakad forest, Kalakad village, Tirunelveli District.

I. INTRODUCTION

Local people in many parts of India are using traditional medicine prepared from medicinal plants or animals found in their locality. Many plant species used for medicinal purposes by local people for long time in the human history was documented in Vedic literature of Charak Samhita and Sushruta Samhita [1]. Many parts of the country were covered with forests which comprise numerous medicinal plants which were extensively used in Aurvedic system of medicine since many centuries [1]. Use of medicinal plants to cure various diseases is a practice from time immemorial.

The traditional knowledge of human being on medicinal values of plant is developed through course of time by co-existence with surrounding floristic diversity [2]. The erosion of traditional knowledge is primarily due to development of modern health-care facilities, commercialization, socio-economic changes [3] and lack of interest on learning the knowledge of indigenous community [4, 5]. Today a demand of traditional medicine has increased considerably due to increasing awareness among the people throughout the world. The increasing demands of medicinal plants exert immense pressure on many wild plant species which leads to depletion of wild plants and posing threats to many species [2, 6, 7].

In developing countries, many people still rely on traditional healing practices and medicinal plants for their daily healthcare needs, in spite of the advancement in modern medicine. However, documentation of this indigenous knowledge of healing system still remains at a minimum level. It thus becomes necessary to acquire and preserve this traditional system of medicine by proper documentation and identification of specimens. According to last census 2011, an estimated 65% of Indian population still depend on the traditional medicine, because modern medicine is simply too expensive and treatment is too capital intensive [8]. In India, tribal communities are highly dependent on the natural resources obtained from the surrounding forest regions for treatment of various ailments and diseases. The most common ailments treated are skin problems, burns, wounds, and cuts. Other illnesses alleviated by herbal medicines include respiratory infections, coughs, fevers, colds, gastrointestinal problems, abdominal pains, stomach aches, throat infections, snake bites, and nervous disorders [8, 9]. The documentation of various uses of medicinal plants and their distribution are much essential for proper conservation and management of medicinal plant species. Hence, it is essential to document the traditional knowledge existing in local communities for conservation and sustainable use of medicinal pant resource [2]. Klakad Mundanthurai Reserve Forest is a valuable repository of floral and faunal biodiversity in the southern Western Ghats of Tamil Nadu, India, both in terms of species richness and endemism [10]. A survey made by Ayyanar et al. [10] reported more than 350 species of ethnomedicinal plants used by the tribal people inhabiting the periphery of the reserve. The present study was carried out in the foothills of Kaakad forest area, Kalakad village, Tirunelveli District, Tamil Nadu, India, in order to collect information about the medicinal plants available in the area that are used by the local people to prevent, alleviate or cure various human diseases.

II. MATERIALS AND METHODS

2. 1. Area of the study

The present study was carried out in Kalakad, a natural village situated at about 45 Kms South-West of Tirunelveli at the foothills of the great Western Ghats in India. Location Name: Kalakad – Latitude 8.5, Longitude: 77.56; Latitude (DMS): 8°30’0 N; Longitude (DMS): 77°34’0 E. The locations -Sivapuram, Moonkilladi, New colony, Chidambarapuram, Paththai, Thalayanai and Mudalirupan are selected for plant survey. Kalakad village is adjacent place of Kalakad Mundandurai Tiger Reserve (KMTR) forest. KMTR is one of the Western Ghats Region, one of the 25 mega biodiversity hotspots of the world, covers 5% of India’s land area, yet contains more than 4000 or 27% of the country’s total plant species. Of these, 1500 species are endemic. Nearly 63% of India’s arborescent evergreen taxa are endemic to the Western Ghats. KMTR, sprawling across a diverse terrain, is ecologically rich. It has vegetation type ranging from thorn scrub to mountain (wet) evergreen forests, all within an altitudinal range from sea level to 1866m above sea level. The exemplary ecological richness have attracted numerous biologists and their findings have enhanced our understanding and appreciation of the biological values of this area.

Table 1. List of medicinal plants collected from the study area.

[LF -Life forms: Cl -Climbers; Li -Lianas; H -Herbs; S -Shrubs; T -Trees; PPU -Plant Parts Used]

Sl. No.	Botanical Name	Family	Local Name	LF	PPU	Name of the Diseases	Available Season
1	*Abrus precatorius* L.	Fabaceae	Guntrimani	Cl	L	Rheumatism;	Whole Year
					R	Cough, Cold;	
					Se	Hair diseases, Ulcer, Skin diseases.	
2	*Abutilon indicum* (L.) Sweet	Malvaceae	Thutti	S	L	Chronic Bronchitis, Gonorrhea, Check Bleeding Piles;	Whole Year
					R	Leprosy, Cooling agent during high fever;	
					StB	Diuretic, Astringent.	
3	*Acalypha fruticosa* Forssk.	Euphorbiaceae	Sirusinni	S	L	Diarrhea.	Whole Year
4	*Achyranthus aspera* L.	Amaranthaceae	Naaiyuruvi	H	WP	Purgative, Carminative, Laxative, Cough, Asthma, Bronchitis, Leprosy, Skin diseases.	Nov. to Feb.
5	*Aegle marmelos* (L.) Correa	Rutaceae	Vilvam	T	Ld	Febrifuge.	Whole Year
					RF	Constipation, Dysentery;	
					UrF	Improve appetite	
6	*Aerva lanata* (L.) Juss. ex Schultes	Amaranthaceae	Cerupulai	H	WP	Astringent, Cooling, Vermifuge, Diuretic.	Nov. to Feb.
7	*Ageratum conyzoide* L.	Asteraceae	Pumpullu	H	WP	Purgative, Carminative, Laxative, Cough, Asthma, Bronchitis, Leprosy, Skin diseases.	Nov. to Feb.
8	*Albizia amara* Bovin	Mimosaceae	Usila maran	T	WP	Antiseptic property.	Whole Year
9	*Aloe vera* (L.) Burm.f.	Liliaceae	Chiru kattalai	H	WP	Astringent, Cooling, Vermifuge, Diuretic.	Whole Year
10	*Alpinia calcarata* Roscoe	Zingiberaceae	Chitarathai	H	R	Cough.	Whole Year
11	*Alterananthera sessils* R. Br.ex Dc.	Amaranthaceae	Ponnankanni keerai	H	WP	Purgative, Carminative, Laxative, Cough, Asthma, Bronchitis, Leprosy, Skin diseases.	Whole Year
12	*Alternanthera pungens* Kunth	Amaranthaceae	Thevedialmul	H	WP	Antiseptic property.	Whole Year
13	*Anacardium occidentale* L.	Anacardiaceae	Mundhiri	T	L	Anti-cancer;	Whole Year
					R	Cough.	
14	*Andrographis paniculat* (Burm.f) Wall. ex Nees	Acanthaceae	Sriyanangai	H	L	Fever, piles.	Whole Year
15	*Annona squamosa* L.	Annonaceae	Seetha maram	T	WP	Astringent, Cooling, Digestive, Constipating, Acrid, Febrifuge.	Whole Year
16	*Apluda mutica* L.	Poaceae	Moongil pul	H	WP	Diuretic, Gonorrhoea.	Nov. to Feb.
17	*Aristida setacea* Retz.	Poaceae	Kudhirai val	H	L	Abortifiacient;	Nov. to Feb.
					WP	Diuretic, Piles.	
18	*Arundo donax* L.	Poaceae	Mudum pul	S	WP	Astringent, Diarrhoea, Dysentery.	Nov. to Feb.
19	*Asparagus gonocladus* Baker	Liliaceae	Shakakal	Cl	WP	Skin diseases.	Nov. to Feb.
20	*Asparagus racemosus* Willd.	Liliaceae	Shatavali	Cl	Rh	Inflammation;	Whole Year
					Se	Diarrhoea	
21	*Asystasia gangetica* T.And.	Acanthaceae	Meddykeerai	S	L	Fever and Skin diseases;	Whole Year
					PEx	Antibacterial.	
22	*Atlantia monophylla* (L.) *Correa*	Rutaceae	Adavinimma	T	L	Ring worm, Parasitic skin infections.	Whole Year
23	*Azadirachta indica* A. Juss.	Meliaceae	Vembu	T	WP	Cooling, Appetizer, Laxative.	Whole Year
24	*Barleria buxifolia* L.	Acanthaceae	Gannukatte mullu	H	R+L	Stomach ache, Tonic, Febrifuge.	Whole Year
25	*Barleria courtallica* Nees	Acanthaceae	Venkurinii	H	L	Healing ulcer;	Whole Year
					RF	Malignant tumours;	
					Se	Abortion;	
26	*Barleria cristata* L.	Acanthaceae	December popu	H	Sl	Cough and Fever.	Whole Year
27	*Basella alba* L. var. alba	Chenopodiaceae	Pasali keerai	H	L	Skin diseases, Wounds.	Nov. to Jan.
28	*Bauhinia purpurea* L.	Caesalpiniaceae	Mandari	T	StB	Laxative;	Whole Year
					FP	Tumour in stomach.	
29	*Bauhinia tomentosa* L.	Caesalpiniaceae	Kanchini	T	L	Abscesses;	Whole Year
					Se	Tonic	
30	*Bidens pilosa* L.	Asteraceae	Mukkuthi	T	Pex	Skin diseases.	Whole Year

31	*Biophytum sensitivum* DC.	Oxalidaceae	Mukkutti popu	H	WP	Diuretic, expectorant, stimulant, tonic.	Nov. to Jan.
32	*Blumea aurita* (L.f.) DC	Asteraceae	Marang-puru	H	L	Stop bleeding from cuts.	Whole Year
33	*Boerhavia diffusa* L.	Nyctanginaceae	Mukarattekirei	H	L	Child birth;	Nov. to Jan.
					R	Jaundice;	
					WP	Liver complaints.	
34	*Borassus flabellifer* L.	Arecaceae	Panai	T	L	Cough;	Whole Year
					R	Cooling, diuretic, stimulant;	
35	*Bulbostylis barbata* C.B. Clarke	Cyperaceae	Thulukaclic pul	T	PD	Dysentery.	Nov. to Jan.
36	*Caesalpinia crista* L.	Caesalpiniaceae	Kalachikai	S	R	Intestinal worms.	Whole Year
37	*Calotropis gigantean* R.Br.	Asclepiadaceae	Erukku	S	Fl	Stomachache, tonic, digestive;	Whole Year
					RB	Paralysis, swelling, intermittent fever;	
38	*Calotropis procera* R. Br.	Asclepiadaceae	Vellerukku	S	Lt	Leprosy, rheumatism, abortifacient, painful joints, swellings and piles;	Whole Year
					LEx	Intermittent fever, rheumatic joints, asthma;	
					FP	Cold cough, asthma, indigestion.	
39	*Canna indica* L.	Cannaceae	Kalvali	S	Rh	Ring worm.	Whole Year
40	*Cardiospermum halicacabum L.*	Sapindaceae	Mudakkathan keerai	Cl	RD	Emetic.	Whole Year
					LJ	Diabetes.	
41	*Carica papaya* L.	Caricaceae	papaya	T	Fr	Laxative;	Whole Year
					SP	Anti-fertility drug.	
42	*Carissa carandas* L.	Apocynaceae	Kalakkad	S	Fr	Skin diseases, burning sensation;	Whole Year
					R	Stomach disorder.	
43	*Cassia absus* L.	Caesalpinaceae	Kattukollu	H	L	Ring worm, other skin diseases;	Nov. to Feb.
					Se	Blood pressure;	
44	*Cassia alata* L.	Caesalpiniaceae	Vandu kollu	H	LJ	Vermifuge;	Whole Year
					Se	Skin troubles.	
45	*Cassia angustifolia* L.	Caesalpiniaceae	Senna	S	L	Skin diseases, constipation, pimples, rheumatism, purgative.	Whole Year
46	*Cassia auriculata* L.	Caesalpiniaceae	Avarai	H	R+L+F	Diabetes and urinary troubles.	Whole Year
47	*Cassia fistula* L.	Caesalpiniaceae	Sarakkondrai	T	Pp	Purgative, intestinal obstructions.	Whole Year
48	*Cassia mimosoides* L.	Caesalpiniaceae	Nelaponna	H	L+Se	Stomachache, headache.	Whole Year
49	*Cassia tora* L.	Caesalpiniaceae	Usithagarai	H	L	Purgative.	Whole Year
50	*Catharanthus roseus* (L.) G. Don.	Apocynaceae	Nithya kalyani	H	L	Sedative, stomach ache;	Nov. to Feb.
					R	Leukemia, breast cancer other related problems.	
51	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Ilavam	S	StB	Stimulant, digestive, laxative;	Whole Year
					Se	Abortifacient, brain tonic.	
52	*Celosia argentea* L.	Amaranthaceae	Pannai keerai	S	Se	Diarrhea, diseases of eyes;	Nov. to Feb.
					WP	Antiprotozoal, spasmolytic.	
53	*Centella asiatica* (L.) Urban	Apiaceae	Vallarai	Cl	L	Diuretic, alternative, skin diseases, leprosy;	Nov. to Feb.
					LP	Improve memory power, concentration of mind.	
54	*Chlorophytum tuberosum (Roxb.) Baker*	Liliaceae	Vaipuruthi	H	St	Cardiac diseases.	Whole Year
55	*Chrozophora rottleri* Juss.	Euphorbiaceae		S	WP	Emetic.	Whole Year
56	*Chrysanthemum coranarium* L.	Asteraceae	Chamanttippu	S	Fl	Insecticide.	Nov. to Feb.
57	*Citrullus colocynthis* Schrad.	Cucurbitaceae	Cumuttikai	S	Fr+Se	Jaundice, urinary diseases.	Whole Year
58	*Citrus aurantifolia* Swingle.	Rutaceae	Kattu elumichi	T	Fr	Blood purifier, improve appetite;	Whole Year
					FrR	Diarrhea.	
59	*Citrus limon (L.) Burn.f.*	Rutaceae	Malai elumichi	T	Fr	Vomiting, heart burn, cough, bronchitis.	Whole Year
60	*Cleome felina* L. f.	Cleomaceae		H	WP	Vesicant, vermifuge.	Nov. to Feb.
61	*Cleome viscosa* L.	Cleomaceae	Naikaduku	H	Se	Stimulant, carminative.	Nov. to Feb.
62	*Clerodendrum inerme (L.) Gaertn.*	Verbenaceae	Pinchil	S	R+L	Skin diseases.	Whole Year
63	*Clitoria ternatea* L.	Fabaceae	Sangu pushpam	Cl	R+L	Eruptions; Refrigent, laxative andintellect promoting.	Whole Year
64	*Cocculus hirsutus* (L.) Diels.	Menispermaceae	Kattukodi	H	R+LJ	Eczema; Laxative.	Whole Year
65	*Colacasia esculenta* (L.) Schott.	Araceae	Sempu	S	LJ	Stimulant.	Whole Year
66	*Coldenia procumbens* L.	Boraginaceae	Seruppadai	S	R+L	Wounds, bruises; Epilepsy.	Whole Year
67	*Commelina benghalensis* L.	Commelinaceae	Kannom vazhai	H	WP	Haemorrhage, fever.	Nov. to Feb.
68	*Corchorus trilocularis* L.	Tiliaceae	Kattu chanal	S	L	Astringent;	Whole Year
					Fr	Jaundice.	
69	*Cordia oblique* Wild.	Boraginaceae	Ottupalam	H	Fr	Expectorant, astringent.	Whole Year
70	*Crossandra infundibuliformis* Nees	Acanthaceae	Kannakambaram boovu	S	Se	Astringent.	Whole Year

71	*Crotalaria juncea* L.	Fabaceae		H	R+L+Se	Fever, dysentery, blood disorders.	Whole Year
72	*Crotalaria retusa* L.	Fabaceae	Thanthala kotti	H	Se	Digestive, skin diseases;	Whole Year
					WP	Scabies, Astringent, expectorant.	
73	*Cryptolepis buchananii* Roem. & Schult.	Periplocaceae	Paul kodi	Li	Lt	Rheumatism;	Whole Year
					Ld	Dropsy.	
					Se	Cool down the temperature during high fever.	
74	*Cuscuta relexa* Roxb.	Convolvulaceae	Kodiyakumdal	Cl	Se	Carminative.	Whole Year
75	*Cyanotis cristata (L.) D. Don*	Commelinaceae	Banrasum	H	RP	Swelling on neck region.	Whole Year
76	*Cyanotis axillaris* L.	Commelinaceae	Nirpulli	H	WP	Dropsy.	Whole Year
77	*Cympobogon nardus (L.) rendle*	Poaceae	Kavattampel	S	L	Digestive disorders,eye diseases.	Whole Year
78	*Cynodon dactylon* (L.) Pers.	Poaceae	Arugampul	H	Rh	Urinogenital troubles diseases of eyes and skin diseases;	Whole Year
					WP	Astringent, Stomach Ache and stimulant.	
79	*Cyperus iria* L.	Cyperaceae		H	WP	Astringent, stomach ache & stimulant.	Nov. to Feb.
80	*Cycas circinalis L.*	Cycadaceae		T	Se	Sex inducer.	Whole Year
81	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae	Kakka kalpul	S	Se	Kidney stones.	Nov. to Feb.
82	*Datura metel* L.	Solanaceae	Umattheu	H	L	Whooping cough, bronchitis heat dandruff, lice;	Whole Year
					R	Rapies dog bites;	
83	*Desmodium triflorum* (L.) DC.	Fabaceae	Sirupulladi	S	WP	Dysentery and diarrhea.	Whole Year
84	*Dichrostachys cinera* (L.) Wight & Arn.	Mimosaceae	Vittattalai	T	R	Astringent, digestion, constipation	Whole Year
					YSt	and anti-inflammatory; Opthalmia.	
85	*Digera muricata* (L.) Mart.	Amaranthaceae	Thuvayal keerai	S	Pd	Laxative.	Whole Year
86	*Dipterocanthus prostrates* (Poir.) Nees	Acanthaceae	Vaedi chedi	T	WP	Ear troubles.	Whole Year
87	*Dodonea viscosa* (L.) Jacq.	Sapindaceae	Virali	S	L	Febrifuge.	Whole Year
88	*Echinochloa colona (L.) Link*	Poaceae	Karumpul	H	RP	Burning pain on the skin.	Nov. to Feb.
89	*Eichhornia crassipes* (Mart.) Solms-Laub.	Pontederiaceae	Aahaya Thamarai	H	LJ	Chronic skin diseases.	Whole Year
90	*Eleusine coracana* (L.) Gaertn.	Poaceae	Ragi	H	Se	Diabetes and measles.	Nov. to Feb.
91	*Emilia sonchfolia* (L.) DC.	Asteraceae		T	WP	Astringent, ophthalmic.	Nov. to Feb.
92	*Enicostemma axillare* Lam.	Gentianaceae	Vellerugu	H	WP	Digestive, carminative, stomachache anti-inflammatory.	Nov. to Feb.
93	*Epaltes divaricata* (L.) Cass.	Asteraceae		H	R	Astringent, tonic.	Nov. to Feb.
94	*Euphorbia antiquorum* L.	Euphorbiaceae	Sathura kalli	S	WP	Digestive, purgative.	Whole Year
95	*Euphorbia indica* Lam.	Euphorbiaceae		S	WP	Diarrhea, dysentery.	Whole Year
96	*Euphorbia nivulia* Buch.	Euphorbiaceae	Nagakalli	H	WP	Ear ache, rheumatism, curing wounds.	Whole Year
97	*Euphorbia thymifolia* L.	Euphorbiaceae	China amman pacharisi	H	WP	Ring worm, wounds, asthma, Skin diseases, leprosy.	Nov. to Feb.
98	*Euphorbia tirukalli* L.	Euphobiaceae	Tirukalli	S	Lt	Warts.	Whole Year
99	*Euphorbia tortilis* Rottl.	Euphorbiaceae	Tirugu kalli	S	PJ	Poison.	Whole Year
100	*Ficus racemosa L.*	Moraceae	Atthi	T	R+RB	Secretion of breast milk.	Whole Year
101	*Flacourtia indica* Merr.	Flacourtiaceae	Kattukadalai	T	StB	Cholera.	Whole Year
102	*Geisekia pharnaceoides* L.	Molluginaceae	Manali keerai	S	Se	Astringent.	Nov. to Feb.
103	*Glinus lotoides* L.	Molluginaceae	Siru cheruppadai	S	YSt	Abdominal disorders.	Nov. to Feb.
104	*Glorioa superba* L.	Liliaceae	Kanualli chedi	S	LJ	Lice;	Nov. to Feb.
					Rh	Abortifacient, digestive, stomach ache, leprosy, purgative & expectorant.	
105	*Glycosmis pentaphylla* DC.	Rutaceae	Amam	S	L	Antidote for eczema, other skin diseases.	Whole Year
106	*Gmelina asiatica* Roxb.	Verbenaceae	Gamnan	S	LP	Swelling throat of cattle;	Whole Year
					RB	Septic wounds;	
107	*Gomphrena globosa* L.	Amaranthaceae	Vada malli	S	R	Cough.	Whole Year
108	*Haldina cordifolia* (Roxb.) Ridsdale	Rubiaceae	Manja kadambu	S	WP	Antiseptic property.	Whole Year
109	*Hedyotis corymbosa (L.) Lam.*	Rubiaceae		S	WP	Intermittent fever, jaundice, other liver troubles.	Whole Year
110	*Hedyotis herbacea* L.	Rubiaceae		S	L	Expectorant.	Whole Year
111	*Hedyotis puberula (G. Don.) Arn.*	Rubiaceae		S	R+L	Asthma, bronchitis.	Whole Year
112	*Hibiscus rosa-sinensis* L.	Malvaceae	Chemparuttai	S	L	Cooling effect.	Whole Year
					F	Epilepsy, diabetes, skin disorders and cardiac diseases;	
113	*Hibiscus sabdariffa* L.	Malvaceae	Adukku chemparuthi	S	WP	High blood pressure.	Whole Year
114	*Hibiscus surattensis* L.	Malvaceae	Kasili keerai	S	WP	Cough.	Whole Year
115	*Hiptage benghalensis* (L.) Kurz.	Malphigiaceae	Vasandi	Li	LP	Scabies.	Whole Year

116	*Hygrophila auriculata* (Schum.) Heine	Acanthaceae	Neer mulli	S	Se+R	Urino-genital system troubles.	Whole Year
117	*Hyptis suaveolens* (L.) Poit.	Lamiaceae		H	R	Stomachache.	Whole Year
					L	Colic disorders;	
118	*Indigofera asoalathoides* Vahl ex DC	Fabaceae	Sivanar vempu	H	Fl+L+Yst	Abscesses, Demulcent, leprosy.	Nov. to Mar.
119	*Indigofera caerulea* Roxb.	Fabaceae	Nelliavuri	S	LP	Jaundice.	Whole Year
120	*Indigofera linnaei* Ali.	Fabaceae	Seppu nerunchi	S	WP	Diuretic, venereal diseases.	Whole Year
121	*Indigofera trita* L.f.	Fabaceae		S	Se	Nutritive tonic.	Whole Year
122	*Indoneesiella echinoides* (L.) Sreemadh.	Acanthaceae	Kopuranthanki	S	WP	Febrifuge.	Whole Year
123	*Ipomea obscura* (L.) Ker-Gawl.	Convolvulaceae	siruhali	Cl	L	Eye diseases.	Whole Year
124	*Ipomoea carnea* Jacq.	Convolvulaceae	Kattu poovarasu	S	L	Mild purgative.	Whole Year
125	*Ipomoea quamoclit* L.	Convolvulaceae	Mair manikkam	S	L	Blood purifier;	Whole Year
					RP	Stomach ache.	
126	*Ixora coccinea* L.	Rubiaceae	Vetchi	S	L	Eye troubles, vulnerary;	Whole Year
					R	Stomach ache, diarrhea, dysentery.	
127	*Jatropha curcas* L.	Euphorbiaceae	Kattamanakku	S	Lt	Wounds;	Whole Year
					L	Ulcers tumors, scabies;	
					Se	Wounds, skin diseases.	
128	*Jatropha glandulifera* Roxb.	Euphorbiaceae	Vellai kattukottai	S	R	Purgative, ulcer glandular swelling;	Whole Year
					Se	Purgative.	
129	*Jatropha gosspifolia* L.	Euphorbiaceae	Adalaie	S	L	Boils, itches;	Whole Year
					R	Epidemic diseases.	
130	*Jatropha multifida* L.	Euphorbiaceae	Kattu nervalam	S	Lt	Wounds, ulcers;	Whole Year
					L	Scabies;	
					Se	Purgative, emetic.	
131	*Justocia adathoda* L.	Acanthaceae	Adathoda	S	L	Expectorant, asthma, chest disorders, skin diseases,	Whole Year
132	*Kleinia grandilora* (wallich ex DC.) Rani	Asteraceae	Thelkadi chedi	S	WP	Pimples.	Whole Year
133	*Kyllinga brevifolia* Rottb.	Cyperaceae		S	Rd	Liver disorders, diabetics.	Nov. to Mar.
134	*Lactuca runncinata* DC.	Asteraceae	-	S	WP	Diuretic, tonic.	Nov. to Mar.
135	*Lannea coromandelica* Merr.	Anacardiaceae	Udhiramaram	T	L	Stop bleeding from cuts.	Whole Year
136	*Lawsonia inermis* L.	Lythraceae	Maruthani	S	L	Skin troubles.	Whole Year
137	*Leucas aspera* (wild.) Link	Lamiaceae	Thumbai	H	L	Cough, bronchitis.	Nov. to Mar.
138	*Luffa cylindrical (L.) M. Roem.*	Cucubitaceae	Melugu peerkku	S	R	Liver functioning.	Nov. to Mar.
139	*Maerva apetala* (Roth) Jacobs	Capparaceae	Iruvalli	T	R	Leucoderma.	Whole Year
140	*Marsilea minuta L.*	Marsileaceae	Oral intake	H	L	Cough.	Nov. to Mar.
141	*Mangifera indica* L.	Anacardiaceae	Mango	T	L+Se+StB+Fr	Laxative, diuretic, refreshing, astringent, diarrhea.	Whole Year
142	*Manilkara zapota* (L.) P. Royen	Sapotaceae	Sapota	T	StB	Tonic;	Whole Year
					Se	Diuretic.	
143	*Melia azedarch* L.	Meliaceae	Malaivempu	T	L	Rheumatism.	Whole Year
144	*Melochia corchorifolia* L.	Sterculiaceae	Pinnakkupundu	S	L	Laxative.	Whole Year
145	*Merremia tridentate* Hall. F.	Convolvulaceae		S	WP	Astringent, laxative, tonic.	Whole Year
146	*Mimosa pudica* L.	Mimosaceae	Thottal chininkui	H	L	Tonic, wounds, haemorrhages;	Whole Year
					R	Astringent, cooling, diuretic, constipating.	
147	*Mimusops elengi* L.	Sapotaceae	Mahilum	T	StB	Tonic, astringent, febrifuge.	Whole Year
148	*Mirabilis jalaba* L.	Nyctanginaceae	Anthi mantharai	S	R	Dropsy;	Nov. to Feb.
					RP	Laxative.	
149	*Mollugo nudicaulis* Lam.	Molluginaceae	Parpadagam	H	L	Boils.	Nov. to Mar.
150	*Mollugo pentaphylla* L.	Molluginaceae	Seeragapoondu	H	WP	Antiseptic, sores.	Nov. to Mar.
151	*Mukia maderaspatana* M. Roem.	Cucurbitaceae	Musumusukkai	Cl	WP	Expectorant, carminative, refrigerant.	Nov. to Mar.
152	*Muntingia calabura* L.	Elaeocarpaceae		S	Fl+Fr	Headache, incipient colds.	Whole Year
153	*Murraya koengii (L.) Spreng.*	Rutaceae	Kariveppilai	T	L+StB+R	Cooling, carminative, antiseptic, anti-inflammatory, skin diseases, leprosy, leucoderma.	Whole Year
154	*Nerium oleander* L.	Apocynaceae	Arali	S	L	Powerful repellent, febrifuge, diuretic, scabies and leprosy;	Whole Year
					R	Astringent, stomachache, febrifuge, diuretic;	
155	*Pavonia odorata* Willd.	Malvaceae	Perumutti	H	R	Stomachache, refrigerant, dysentery, intestinal hemorrhage.	Nov. to Mar.
156	*Pedalium murex* L.	Pedaliaceae	Aanai nerungi	H	WP	Cooling, digestive, carminative tonic, anti-inflammatory.	Nov. to Mar.
157	*Percularia daemia* Chiov.	Asclepiadaceae	Veloparutthi	Cl	WP	Emetic, expectorant, laxative.	Whole Year
158	*Sida rhombifolia* L.	Malvaceae	Kurunthotti	H	WP	Treat headache, inflammation in eyes.	Nov. to Mar.
159	*Sida spinosa* L.	Malvaceae		H	L	Cronary heart diseases, Asthma, Blood Pressure, Gonorrhea, Gleet, Scaling urine.	Whole year
					R	Fever, debility as demulcent	

Fl -Flower; **FP** -Flower Powder; **Fr** -Fruit; **FrR** -Fruit Rind; **L** -Leaf; **LEx** -Leaf extract; **LJ** -Leaf juice; **LP** -Leaf Paste; **Lt** -Latex; **PEx** -Plant extract;
L+R -Leaf and Root; **LD** -Leaf decoction; **PD** -Plant decoction; **PJ** -Plant Juice; **Pp** -Pod pulp; **R** -Root; **RB** -Root Bark; **Rh** -Rhizome; **RD** -Root decoction;
RF -Ripe fruits; **RP** -Root Paste; **Se** -Seed; **Sl** -Seeling; **St** -Stem; **StB** -Stem Bark; **SP** -Seed Powder; **UrF** -Unripe Fruits; **WP** -Whole Plant; **YSt** -Young Stem;

2.2. Medicinal plant survey

Medicinal plant survey was carried out in and around the Kalakad village such as Sivapuram, Moonkilladi, New-colony, Chidambarapuram, Paththai, Thalayanai and Mudalirupan, to collect information about use of medicinal plants (Table 1). During the study period (November 2012 to June 2014), various information was collected through repeated interview made with experienced local people (men and women between the ages of 50 to 75 years) including local traditional herbal medicine practitioners like Murugan, Gomathinathen, Karuppasamy, Kaalankarayan, etc., about the uses of medicinal plants, its local name, useful parts and available season, etc.

III. RESULTS AND DISCUSSION

Field work in the study area was carried out from November, 2012 to June, 2014 by regular, frequent and periodical visits. During the field visits, various information related to medicinal plants used by the local people were collected with the help of several elder and experienced peoples (men and women between the ages of 50 to 75 years). The gathered information is presented in Table 1.

The detailed medicinal plant survey reveals that a total of 159 plant species belonging to 54 families and 124 genera were recorded from the foothills of Kalakad forest area, Kalakad village. Out of 159 species recorded, 157 species categorized as Angiosperm, 1 species as Gymnosperm and 1 species as Pteridophyte taxonomic groups (Figure 1 and 2). Among the 54 families, Euphorbiaceae is the largest and family with 12 species, followed by Acanthaceae, Caesalpiniaceae (10 species each), Fabaceae (9 species), Asteraceae, Poaceae (8 species each), Malvaceae and Amaranthaceae (7 species each), Rutaceae (6 species), Convolvulaceae, Liliaceae, and Rubiaceae (5 species each), Molluginaceae (4 species), 7 families represents 3 species each, 8 families represents 2 specie each, and 26 families represent each 1 species only (Table 2). Similarly, out of 54 families reported, 3 families (Acanthaceae, Asteraceae and Poaceae) represented with 8 genus each, Ameranthaceae with 6 genus, Fabaceae and Rutaceae represent with 5 genus each, Euphorbiaceae, Malvaceae and Liliaceae with 4 genus, 9 families with 3 genus, 9 families with 2 genus and 27 families with one genus only Table 2). Out of 124 genera reported, 106 genera are monotypic.

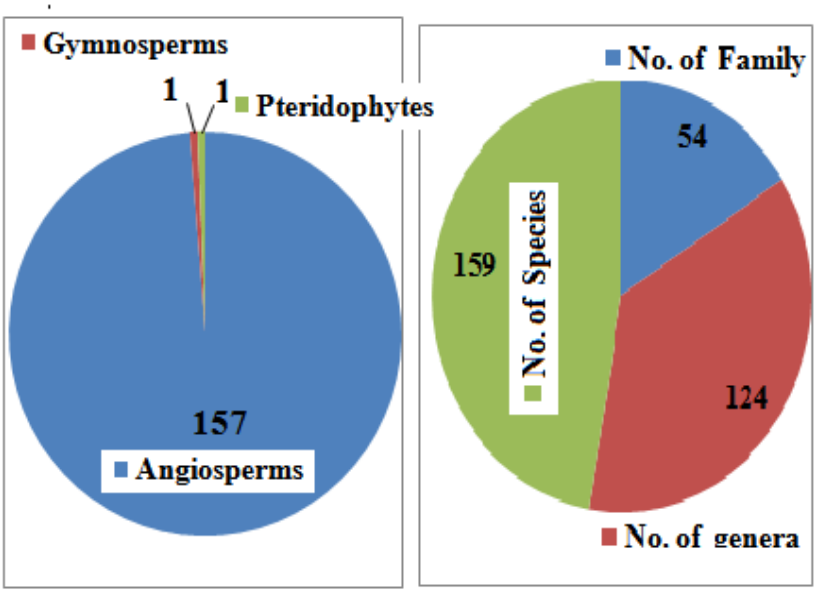

Figure 1. Pattern of medicinal plant distribution in the study area.

Table 2. Number of genus and species present in each family recorded in the study area.

Sl. No.	Family	No of Genus (%)	No of Species (%)	Sl. No.	Family	No of Genus (%)	No of Species (%)
1	Euphorbiaceae	4(3.23)	12(7.55)	28	Boraginaceae	2(1.61)	2(1.26)
2	Acanthaceae	8(6.45)	10(6.29)	29	Elaeocarpaceae	1(0.81)	1(0.63)
3	Caesalpiniaceae	3(2.42)	10(6.29)	30	Pedaliaceae	1(0.81)	1(0.63)
4	Fabaceae	5(4.03)	9(5.66)	31	Zingiberaceae	1(0.81)	1(0.63)
5	Asteraceae	8(6.45)	8(5.03)	32	Annonaceae	1(0.81)	1(0.63)
6	Poaceae	8(6.45)	8(5.03)	33	Pontederiaceae	1(0.81)	1(0.63)
7	Malvaceae	4(3.23)	7(4.40)	34	Gentianaceae	1(0.81)	1(0.63)
8	Amaranthaceae	6(4.84)	7(4.40)	35	Moraceae	1(0.81)	1(0.63)
9	Rutaceae	5(4.03)	6(3.77)	36	Flacourtiaceae	1(0.81)	1(0.63)
10	Convolvulaceae	3(2.42)	5(3.14)	37	Sterculiaceae	1(0.81)	1(0.63)
11	Liliaceae	4(3.23)	5(3.14)	38	Arecaceae	1(0.81)	1(0.63)
12	Rubiaceae	3(2.42)	5(3.14)	39	Capparaceae	1(0.81)	1(0.63)
13	Molluginaceae	3(2.42)	4(2.52)	40	Chenopodiaceae	1(0.81)	1(0.63)
14	Mimosaceae	3(2.42)	3(1.89)	41	Bombacaceae	1(0.81)	1(0.63)
15	Asclepiadaceae	2(1.61)	3(1.89)	42	Apiaceae	1(0.81)	1(0.63)
16	Apocynaceae	3(2.42)	3(1.89)	43	Menispermaceae	1(0.81)	1(0.63)
17	Anacardiaceae	3(2.42)	3(1.89)	44	Araceae	1(0.81)	1(0.63)
18	Cyperaceae	3(2.42)	3(1.89)	45	Malphigiaceae	1(0.81)	1(0.63)
19	Commelinaceae	2(1.61)	3(1.89)	46	Lythraceae	1(0.81)	1(0.63)
20	Cucurbitaceae	3(2.42)	3(1.89)	47	Tiliaceae	1(0.81)	1(0.63)
21	Sapindaceae	2(1.61)	2(1.26)	48	Cannaceae	1(0.81)	1(0.63)
22	Cleomaceae	1(0.81)	2(1.26)	49	Cycadaceae	1(0.81)	1(0.63)
23	Verbenaceae	2(1.61)	2(1.26)	50	Oxalidaceae	1(0.81)	1(0.63)
24	Sapotaceae	2(1.61)	2(1.26)	51	Caricaceae	1(0.81)	1(0.63)
25	Meliaceae	2(1.61)	2(1.26)	52	Periplocaceae	1(0.81)	1(0.63)
26	Nyctanginaceae	2(1.61)	2(1.26)	53	Solanaceae	1(0.81)	1(0.63)
27	Lamiaceae	2(1.61)	2(1.26)	54	Marsileaceae	1(0.81)	1(0.63)
					Total	**124(100.00)**	**159(100.00)**

Table 3. IUCN Status of the medicinal plant species collected from the study area.

Sl. No.	Botanical Name	IUCN Status
1	*Alternanthera sessilis* (L.) R.Br. ex DC.	Least Concern
2	*Bauhinia purpurea* L.	Least Concern
3	*Bauhinia racemosa* Lam.	Least Concern
4	*Centella asiatica* (L.) Urb.	Least Concern
5	*Cynodon dactylon* (L.) Pers.	Least Concern
6	*Percularia daemia* R.Br.	Least Concern
7	*Gloriosa superba* L.	Least Concern
8	*Hygrophila auriculata* (Schumach.) Heine.	Least Concern
9	*Mimosa pudica* L.	Least Concern
10	*Hiptage benghalensis* (L.) Kurz.	Rare in South India
11	*Maerva apetala* (Roth) Jacobs	Rare in South India
12	*Cycas circinalis* L.	Endangered

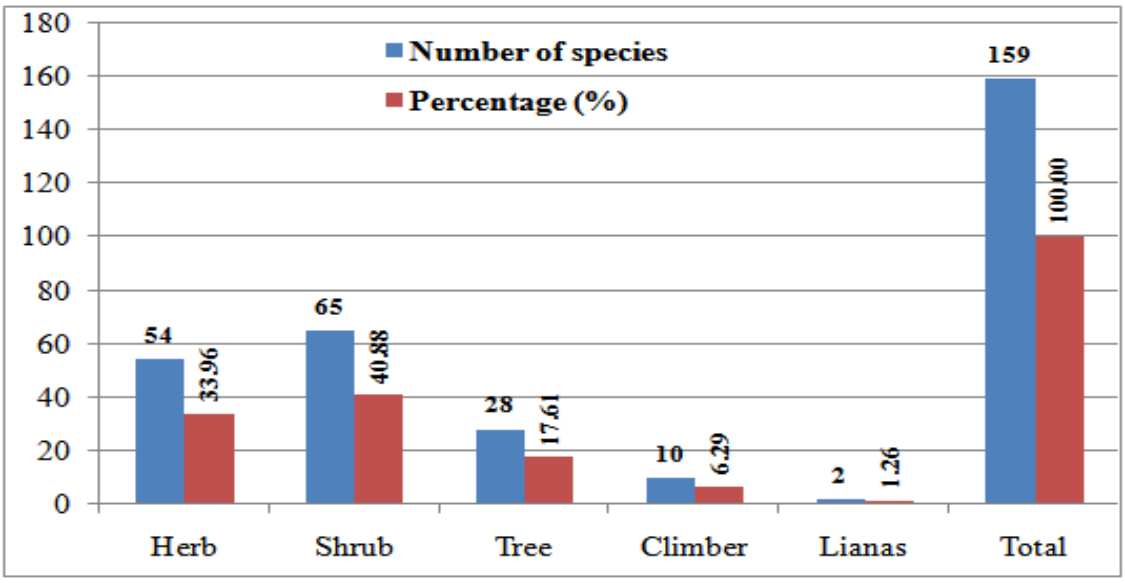

Figure 2. Number and percentage of medicinal plants categorized based on its life forms.

Table 3 indicates the IUCN status of 12 medicinal plants collected in the study area. Among the 12 species, 1 species under endangered category, 2 species rare in South India category and 9 species under least concern category. The life form status of the medicinal plants recorded from the study area shows (Figure 2) that shrub was the dominant life form representing 65 species (40.88%) followed by herbs with 54 species (33.96%), trees with 28 species (17.61%), climbers with 10 species (6.29%) and lianas with 2 species (1.26%).

Table 4. Number of medicinal plant parts and number of medicinal plant species used by local people for remedies (curing various diseases) in the study area.

Sl. No.	Name of the plant parts used	No. of diseases treated	% of diseases treated	No. of plant species used	% of plant species used
1	Flower & its products	13	12.26	13	8.18
2	Fruit & its products	18	16.98	21	13.21
3	Latex	9	8.49	11	6.92
4	Leaf & its products	53	50.00	101	63.52
5	Rhizome	11	10.38	12	7.55
6	Root & its products	40	37.74	67	42.14
7	Seed & its products	23	21.70	32	20.13
8	Stem & its products	10	9.43	13	8.18
9	Whole plant & its products	51	48.11	130	81.76
10	More than one plant parts used	24	22.64	29	18.24
	Total -(number of Diseases & Plant species recorded)	**106**		**159**	

The diversity of medicinal plant parts used to cure diseases noted and the data shows in Table 4. Among the 10 categories of plant parts used for medicinal purposes, leaf and their products are the most frequently used one, either fresh or dried. Leaves of many medicinal plants used in maximum number of remedies (53 diseases; 50%) and is followed by whole plant and their products in 51 (48.11%) remedies, roots in 40 remedies and seeds in 23 remedies (Table 4). About 24 remedies (22.64%) are done with more than one part of the medicinal plants in various combinations. Stems and roots are also used either fresh or by decocting the dried root in water. Stems are usually cut into small pieces and decocted in water. Often, different parts of the plants are combined to treat a disease. The local people in Kalakad area use different plant parts to treat different diseases. Different components of one medicinal plant may have different effects. Some medicinal plant species have only one component that can be used, while for other species several components or the whole plant can be used. A maximum of 130 medicinal plants (81.76%) was used as whole plants in 51 remedies while 101 medicinal plant species (63.52%) leaf and their products used to cure 50% (53 diseases) and 67 medicinal plant species (42.14%) used to cure about 40 diseases (37.74%) with roots and their products (Table 4).

Table 5. Comparison of number of medicinal plant parts and number of medicinal plant species used for various diseases by the local people in the study area.

Sl. No.	Plant parts used	No of Diseases Cured (%)
1	One part of the plants	50 (47.17)
2	Two parts of the plants	16 (15.09)
3	Three parts of the plants	18 (16.98)
4	Four parts of the plants	8 (07.55)
5	Five parts of the plants	4 (03.77)
6	Six parts of the plants	6 (05.66)
7	Seven parts of the plants	4 (03.77)
	Total	**106 (100.00)**
Sl. No.	**Plant species used**	**No of diseases Cured (%)**
1	Single (one) Species only	41(38.68)
2	2 –Species	16 (15.09)
3	3 –Species	12 (11.32)
4	4 –Species	7 (06.60)
5	5 –Species	6 (05.66)
6	6 –Species	2 (01.89)
7	7 –Species	3 (02.83)
8	8 –Species	4 (03.77)
9	9 –Species	4 (03.77)
10	10 –Species	1 (00.94)
11	11 –Species	2 (01.89)
12	12 –Species	1 (00.94)
13	13 –Species	2 (01.89)
14	15 –Species	3 (02.83)
15	20 –Species	1 (00.94)
16	26 –Species	1 (00.94)
	Total	**106 (100.00)**

Among the 106 diseases, recorded about 50 diseases treated with only one part of medicinal plants, 18 diseases cured with 3 parts of the medicinal plants, 16 remedies with 2 parts, 8 diseases with 4 parts, 6 diseases with 6 pars of medicinal plants, and 4 diseases with 5 or 7 parts of medicinal plants (Table 5). Similarly, about 41 diseases cured with only with one medicinal plant species (monotypic) while 16 diseases cured with 2 species, 12 diseases with 3 species, 7 diseases with 4 species, and remedies like cooling, purgatives, astringent, and skin problems were done with 10, 12, 20 and 26 species of medicinal plants, respectively (Table 5). The mode of administration includes oral intake, application to external body parts, rubbing/massage and inhalation. Most of the plant species were administered orally, mainly as a decoction or extracted from plant parts. A high number of species were externally applied mostly to treat wounds, snake bites, itches and bleeding. Rubbing applied to treat back pain, muscle pain and in only four remedies local people applied as inhalation.

Table 6. Human diseases treated with more number of plant species and plant parts.

Sl. No.	Ailments	No. of plant parts used	No. of plant species used
1	Skin diseases	7	26 (16.35)
2	Astringent	6	20 (12.58)
3	Cough	5	15 (09.43)
4	Diuretic	6	15 (09.43)
5	Laxative	7	15 (09.43)
6	Stomach ache	6	13 (08.18)
7	Purgative	6	12 (07.55)
8	Leprosy	6	11 (06.92)
9	Digestive problems	7	11 (06.92)

Among the human diseases, skin problems cured with a maximum of 26 medicinal plants (16.35%) using 7 plant parts (Table 6). Twenty plant species (12.58%) used as astringent by using 6 plant parts. About 9.43% plant species (15sps.) used as diuretic and laxative, and to cure cough by using 6, 7 and 5 plant part, respectively.

The results of present study indicate that different parts of medicinal plants were consumed as medicine in various forms by the local people and the traditional medical practitioners to treat various human diseases. It was also observed that most of the remedies consisted of single plant using one part of the plants. This study emphasized various plant remedies practiced by the local people. The knowledge of effectiveness of these plants can increase the health care systems and there is a need to be evaluated through phytochemical analysis to discover their competence in developing effective medicines for curing different diseases in human beings. The traditional knowledge of local people and the medical practitioners has been passing from generation to generation and played an important role in the conservation and sustainable development of biodiversity.

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