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Research Article

ETHNOMEDICINE STUDY ON MEDICINAL PLANTS IN THE MANAR BEAT OF KARAMADAI RANGE, WESTERN GHATS, TAMIL NADU, INDIA

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ABSTRACT

An ethnomedicinal survey was undertaken to cram the diversity of medicinal plants in the Manar beat of Karamadai Range, Coimbatore forest division, Western Ghats of Tamil Nadu, India from 2018-2019. The indigenous knowledge of local traditional healers and the native plants used for medicinal purposes were collected in their local language. The ethnobotanical data such as a local name, medicinal uses and mode of preparation was collected through structured questionnaires, personal interviews and consultation with very old and knowledgeable persons in and around the study area. The meteorological information of the study territory was recorded and tabulated. The present study enumerates a total of 104 medicinal plant species of 86 genera and 52 families are documented for the first time. Among these Fabaceae, Mimosaceae and Asclepiadaceae with 7 species are dominant over other families. Herbs are the most widely present life forms followed by trees. Amongst the different plant parts, leaves are the most widely used plant part in therapeutics and also for herbal formulations. According to IUCN threat status, *Pterocarpus marsupium* Roxb. (NT) is in the Near Threatened category, 2 species on this list are under the Endangered (EN) and in Vulnerable (VU) category. Those plants which fall under the vulnerable and endangered category are prescribed for germplasm collection. Therapeutic uses of medicinal plants and their active principles were also reported. Decoction is mostly utilized in the mode of preparation. The traditional healers are lessening in number and there is a grave hazard of traditional information disappearing soon. Since the younger generation isn't interested to carry on this custom. The study dazzled that this area is more pertinent to the conservation of local flora. So, documenting the traditional knowledge is important for sustainable utilization.

Keywords: Ethnomedicine, Medicinal plants, Traditional healer, Manar beat, Western Ghats.

1. INTRODUCTION

India has rich resources of medicinal plants with a wide variety of plants, because of the extreme variations in geographical and climatic conditions prevailing in the country. Over 200 million people in India were relying limitedly on the traditional system of medicine [1].Generally, the Eastern Ghats and Western Ghats in India harbour about 5,332 endemic species of higher plants [2]. Herein, Tamilnadu is rich in medicinal plant diversity, especially in the hilly tract of Western Ghats, which is the storehouse of numerous high-value medicinal plants. Among all, the forests have played key roles in the lives of individuals living in both mountains and lowland areas by providing freshwater and oxygen as well as giving a diversity of valuable forest products in favor of food and medicine [3]. The World Health Organization (WHO) has energized an improvement for "Saving Plants for Saving Lives" this is because of the understanding pivotal role of medicinal plants in providing herbs [4]. Medicinal plants have made a momentous contribution to the primary healthcare of people around the world. They are the wealthy bio-resource for conventional medicinal frameworks, modern medicines, nutraceuticals, food supplements, folk medicines and pharmaceuticals for synthetic drug preparation [5, 6]. Traditional medicine and ethnobotanical data assume a significant role in scientific exploration, especially when the literature and fieldwork information has been appropriately assessed [7].

The data on the use of plant species for therapeutic purpose has been passed from one generation to the next through oral practice, this information on therapeutic plants has begun to decay and become out of date through the lack of recognition by younger generations because they are not interested to carry on this practice

[8]. Although extreme endeavors on investigations and survey activities about medicinal plants remain in the traditional system are still in use but some reserved areas are unexplored. Hence, the present study was aimed to assess the vegetation on unexplored areas and some of the ethnomedicinal information was gathered from tribal peoples of Manar beat, Karamadai reserve forest of the Western Ghats.

2. MATERIAL AND METHODS

2.1. Biogeography of the Study area

The present study shows the diversity of medicinal plants distributed in the Manar beat (Melur slope RF and Nellithurai RF) of Karamadai Range, Coimbatore forest division, Western Ghats of Tamil Nadu, India. The study area, manar beat has an area of 22.7971 km^2 coverage, which lies between 11° 18'N and 76° 53" E. The hill range was situated at about 250 to 1100 meters above sea level and it covers natural flora and fauna. This reserve forest is very popular with botanists and ornithologists as it has a great variety of fauna and flora. Among the animals found in this place are elephant, monkey, mongoose, wild dogs and a fox-tail squirrel while the reptile population includes the king-cobra, python and several other poisonous and non-poisonous snakes.

2.2. Period of study

Frequent field surveys were carried out regularly and seasonally to collect some medicinal floras from Manar beat, Karamadai Range, Coimbatore forest division, Western GhatsfromMay 2018 to December 2019.

2.3. Climatology

Climatic data of study areas such as temperature, rainfall, rainy days, wind speed, pressure, relative humidity, cloud, sun hours and sunny days were collected from District Forest Office, Coimbatore Circle and Karamadai weather source https://www.worldweatheronline.com/lang/en-in/karamadai-weather/tamil-nadu/in.aspx.

2.4. Studied tribal community

The indigenous people inhabited the study area are called Irular. Irulas are a significant ethnic group in India. They are found in the hilly regions and living in different topographic habitats (plains, mountains, valleys, etc.) in Tamil Nadu. Generally, Irulars are illiterate and they speak a different dialect of Tamil, which is distantly related to other Dravidian Tamil. The word 'Irular' got from the Tamil word called 'Irul' which means darkness. They are recognized as a Scheduled Tribe (ST) by the Government of India [9]. The culture of the Irulas has changed minimally in the course of the most recent thousand years. A typical Irula house looks like the kind of house and it is made entirely of stones and mud. Most of the houses don't have doors and their huts are dark with no window or any other opening to admit air. Their staple food comprises of minor millets, grains, vegetables and wild yams enhanced with rice. They don't rehearse agriculture and entirely depend on forest produce and wild animals. Some Irulas trade or sell honey, honey wax, plantations of banana or silk cotton, wild fruits, yams and other native herbal products. Different occupations of the Irulas incorporate discontinuous homestead work and the legendary profession of snake charming. The Forest Department provides job opportunities for both gender people. Women were benefited through Women Self Help Group (WSHGs) their contribution is preparing food for tourists. Ten women's self-help groups were formed in all tribal villages and Rs.10, 000 was allotted to each WSHGs towards a revolving fund for their income generation activities. Men's main occupation is coracle riding in Eco-tourism under the 12th Finance Commission Scheme which supports many families.

2.5. Data collection

A simple work plan was adopted for this survey work. Got prior permission in the Forest Department, at first gathered information about meteorological data and then collected detailed information about tribal population and tribal villages of the Karamadai Range. Additional relevant information was collected from the internet. The ethnobotanical data (local name, medicinal uses, mode of preparation) were collected through interviews and discussions among the tribal practitioners in and around the study area. Data were also collected through general conversations, personal interviews and questionnaires in their local languages (Tamil). In addition to the vernacular name's questions were also asked about medicinal uses and mode of preparation. The collected information was verified with literature, online resources, standard books and some of the data were compared with the already existing literature on the ethnobotany of India. The plant specimens were collected as directed by the taxonomic expert person in flowering and fruiting conditions. Digital photographs of the plants were also taken. Collected plant specimens were dried and

herbarium sheets were prepared for probable identification.

2.6. Identification of medicinal plants

The tentatively identified plant specimens have been critically studied and identified by using local and regional floras [10, 11]. The identities of the plants were confirmed by comparison with authentic specimens deposited in the herbaria of the Botanical Survey of India, Southern Circle, Coimbatore. The voucher specimens were deposited in the Vellalar College herbarium, Erode (VCW/BH/Acc. No...). An updated and correct nomenclature was checked with authentic websites (www.plantlist.org) and also checked the threat status of plant species from IUCN (iucn.org). Each plant species has been arranged alphabetically for correct nomenclature, according to Bentham and Hooker (1862-1883) system of classification. The identified and authenticated species were classified according to their binomial name, family, local name, habit, parts used, cultivation status, ecological status, therapeutic uses, active principles and mode of preparation.

3. RESULTS

The study revealed the rich knowledge of medicinal plants in the Manar beat of Karamadai Range, Western Ghats, Tamil Nadu, India. The study area covers 2279.71 hectares. The climatic data such as temperature, rainfall, rainy days, wind speed, pressure, relative humidity, cloud, sun hours and sunny days of study site were observed for 12 months from January to December 2019 (Table 1 and Fig. 1). The maximum mean monthly temperature during the summer was 37.2°C and the minimum mean monthly temperature during winter was 15.6°C. The average total annual rainfall was 2202.2 mm for the studied year with an average of 272.7 rainy days. The average annual wind speed was ranged between 4.2 kmph to 9 kmph. The maximum pressure in the study area was high in January and the same was lower in June and July. The annual relative humidity was around 41 to 84 percentages. Considering rainfall and rainy days, the cloud conditions have occurred in the range of 12-69 %. Likewise, based on the temperature, the sun hours and sunny days were calculated and recorded in the range of 171 to 292 hrs and 2-24 days respectively.

In the present investigation, a total of 104 plant species were recorded in the survey (Table 2). From the documented surveyed list, 94 were angiospermous plants belonging to 76 genera and 43 families, seven pteridophytic plants belonging to six families, one bryophyte thallus and two types of lichen thallus were identified. The most diverse were Dicots, Monocots, Pteridophytes, Lichens and Bryophytic under families of Fabaceae, Mimosaceae and Asclepiadaceae with 7 spp. Pteridaceae (2 spp.), Caliciaceae, Parmeliaceae (1 spp. each) and Ricciaceae (1 spp.) were dominating by representing a greater number of species.The maximum diversity of species was contributed by the family Fabaceae, Mimosaceae and Asclepiadaceae (7 spp.) followed by Capparidaceae (6 spp. each), Convolvulaceae, Scrophulariaceae and Moraceae (4 spp. each), Caesalpiniaceae, Sapindaceae, Apocynaceae and Acanthaceae (3 spp.), Meliaceae, Rhamnaceae, Aristolochiaceae, Amaranthaceae, Euphorbiaceae, Aizoaceae, Liliaceae, Cactaceae, Ebenaceae, Orchidaceae, Tiliaceae and Pteridaceae (2 spp. each) and the remaining families such as Malvaceae, Vitaceae, Polygonaceae, Sterculiaceae, Rosaceae, Passifloraceae, Verbenaceae, Rutaceae, Anacardiaceae, Asteraceae, Boraginaceae, Commelinaceae, Cucurbitaceae, Elaeagnaceae, Hydrophyllaceae, Lamiaceae, Loranthaceae, Onagraceae, Opiliaceae, Poaceae, Pandanaceae, Adiantaceae, Polypodiaceae, Hemionitidaceae, Marsileaceae, Dennstaedtiaceae, Ricciaceae, Caliciaceae and Parmeliaceae were represented with single species (Fig. 2).

Herbs (33%) were found to be the most used plants (Fig. 3) followed by trees (25%), shrubs (19%) and climbers (11%) in descending order.

Among the different plant parts used by the Irula tribes, leaves with 28 percent constituted the major portion in medicine (Fig. 4). In most of the plant species, more than one plant part was used for therapeutic purposes.

Different creators have expected that these ethnomedicinal species are vanishing from the wild because of unsustainable exploitation and destruction of habitat due to deforestation. In this study, the cultivation status of plant species was documented with previous literature and classified as wild, cultivated and ornamental.

According to IUCN threat status, the ecological statuses of medicinal plants were categorized. Among 104 plant species, 35 species on this list are under Least Concern (LC), 2 species in the Endangered category (EN), *Cayratia pedata* Juss. and *Dalbergia latifolia* Roxb. species are in the Vulnerable category (VU) and 1 species in the Near Threatened (NT). But still, 50% of the taxa in the present study belong to the NE (Not Evaluated) category.

Table 1: Meteorological parameters of the study area

Year and month	Temperature (°C)			Rainfall (mm)	Rainy days	Wind speed (kmph)/ Average	Pressure (mb)	Relative Humidity (%)	Cloud (%)	Sun hours (hr)	Sun days
2019	Max.	Min.	Average								
Jan.	30.2	16.3	24.2	19.7	7	6.3	1014.6	57	16	277	24
Feb.	32.0	19.3	27.5	23.8	12	6.1	1013.5	53	24	244	16
Mar.	36.0	21.3	31.6	8	2.7	6.8	1012.2	43	12	292	23
Apr.	37.0	23.7	32.1	62.6	17	7.1	1010.1	41	31	250.5	13
May.	37.2	24.8	33.5	264.1	28	8.1	1009.1	49	61	205.5	3
Jun.	34.7	24.7	30.2	105.7	27	9	1008.3	61	49	231.5	3
Jul.	32.2	22.1	28.1	274.5	29	7.2	1008.8	67	48	211	2
Aug.	29.0	21.2	27.4	135.5	29	7.9	1009.7	73	52	190	2
Sep.	30.7	20.0	26.7	164.5	30	5.9	1010.2	73	53	193.5	0
Oct.	29.3	18.0	25.1	651.6	31	4.5	1010.9	81	69	155.5	0
Nov.	28.0	16.1	23.5	356.2	30	4.2	1011.8	84	64	171	0
Dec.	27.4	15.6	22.4	136	30	4.3	1012.9	84	59	183.5	0

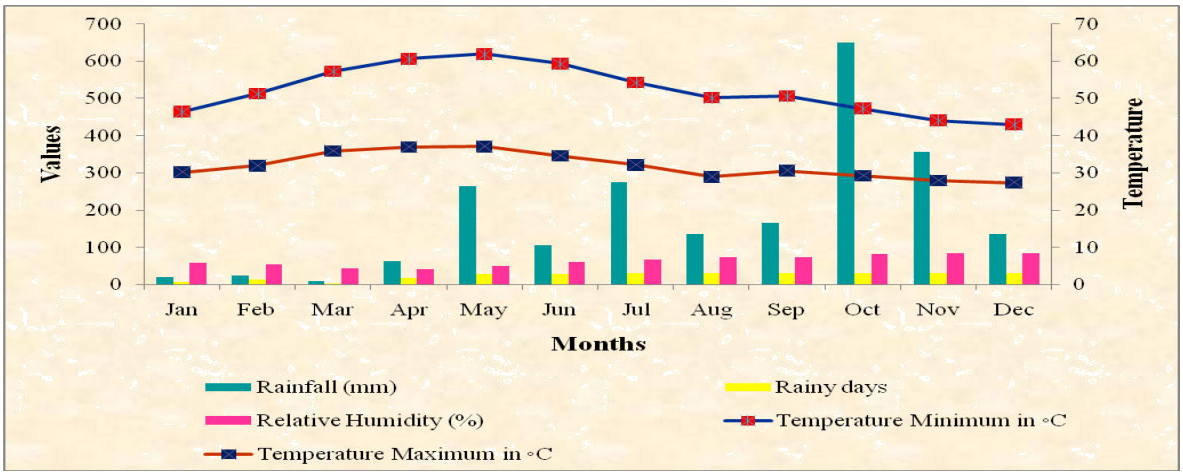

Fig. 1: Ombrothermic Graph of Manar beat

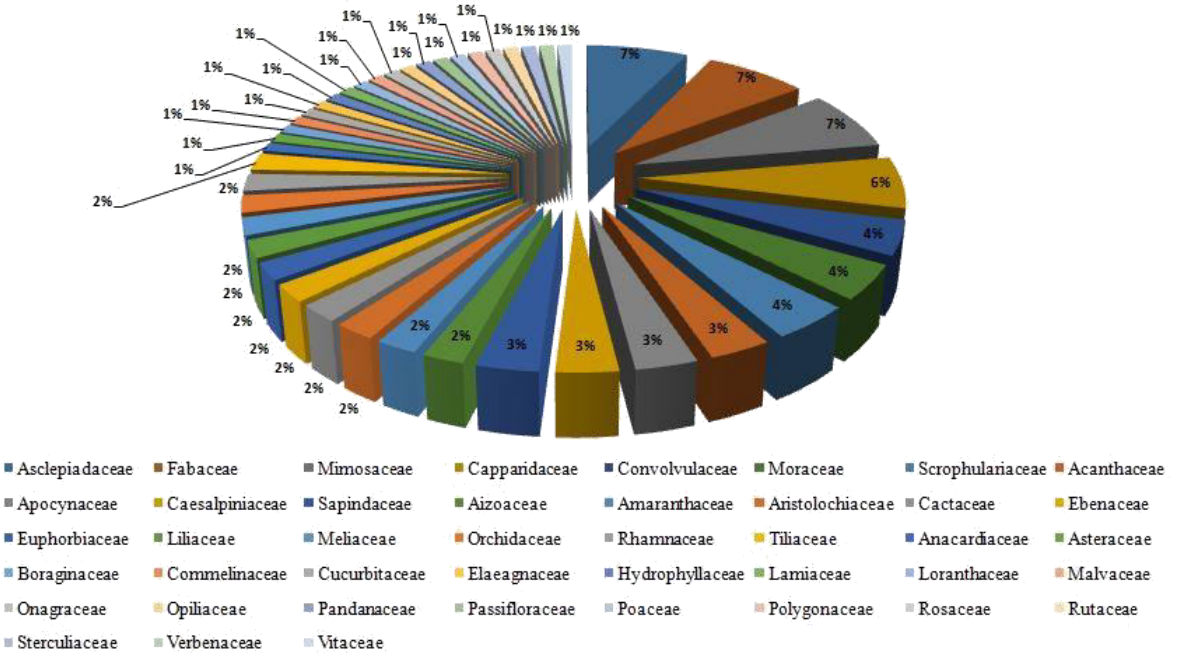

Fig. 2: Pie chart showing the percentage of different families of medicinal plants

Table 2: Summary of surveyed medicinal plants in Manar beat, Karamadai range, Western Ghats, Tamil Nadu, India

S. No	Botanical Name	Family Name	Local Name	Habit	Parts Used	Cultivation Status	Ecological Status	Therapeutic Uses	Active Principles	Mode of Preparation
1.	*Abutilon indicum* G. Don.	Malvaceae	Thutthi	S	Leaves	Ornamental and wild	NE	**Leaves**– Diuretic, used to cure fever, ulcer and wounds	Alkaloids, tannins, glycosides, saponins and phenols	Juice and powder
2.	*Acacia caesia* Willd.	Mimosaceae	Nanjupattai	CS	Bark	Wild	LC (2011)	**Bark** –Dysentery, wounds and skin problems	Tannins and saponins	Paste
3.	*Acacia farnesiana* (L.) Willd.	Mimosaceae	Kastuurivel	S	Bark, roots and flowers	Cultivated, ornamental and wild	LC (2019)	**Bark** – Cough, swelling and bleeding gums **Roots** – Sore throat and diarrhea **Flowers** –Stomach ache and headaches	Phenols and alkaloids	Decoction and paste
4.	*Acacia horrid* (L.) Willd.	Mimosaceae	Seethaimul	T	Leaves and bark	Cultivated, ornamental and wild	NE	**Bark** – Dysentery, leprosy and cough **Leaves**– Cure ulcers	Tannins	Decoction
5.	*Acacia pennata* (L.) Willd.	Mimosaceae	Indan	CS	Leaves and barks	Cultivated and wild	LC (2018)	**Leaves**– Indigestion and bleeding gums **Bark** – Used to treat dysentery and other skin diseases	Tannins	Decoction
6.	*Acalypha paniculata* Miq. BHVCW 04	Euphorbiaceae	Malaikuppa-meni	S	Leaves	Ornamental and wild	NE	**Leaves**– To cure jaundice	Phenols, steroids, flavonoids and saponins	Decoction
7.	*Adatoda vasica* Nees. BHVCW 06	Acanthaceae	Aadaathodai	S	Leaves, roots, flowers and bark	Ornamental and wild	NE	**Roots**– Used for treating bronchitis, asthma, fever and jaundice **Leaves**– Antiseptic **Flowers**– It relieves cough and breathlessness **Bark** – Bleeding gums	Alkaloids, tannins, saponins, phenols and flavonoids	Decoction, juice and powder
8.	*Aegle marmelos* (L.) Correa ex Roxb. BHVCW 07	Rutaceae	Vilvam	T	Leaves, fruits and root	Cultivated and wild	NE	**Leaves**– Ulcer, diabetes **Fruits**– Laxative, demulcent and stomach pain **Root**–Earache	Coumarins, flavonoids, alkaloids, tannins and oil	Decoction and powder

9.	*Aerides crispum* Lindl. BHVCW 08	Orchidaceae	Kantankuli	E	Whole plant	Cultivated	NE	**Whole plant** – Earache	Alkaloids, triterpenoids and flavonoids	Decoction
10.	*Aganosma cymosa* G. Don.	Apocynaceae	Sellakkodi	C	Whole plant and flowers	Cultivated	NE	**Whole plant**– Emetic,anthelmintic and bronchitis **Flowers** – Ophthalmia	Alkaloids	Decoction
11.	*Aglaia elaeagnoidea* (A. Juss.) Benth.	Meliaceae	Gnaazhal	T	Fruits and seeds	Wild	LC (1998)	**Fruits** – Astringent, inflam-mations and cooling **Seeds**– Used in the treatment of painful micturition	Alkaloids	Tonic and paste
12.	*Albizzia lebbeck* Benth. BHVCW 10	Mimosaceae	Vaagei	T	Leaves, seeds and bark	Cultivated, ornamental and wild	NE	**Leavesand seeds** – Eye problems such as ophthalmia **Bark**– Dysentery and piles	Alkaloids and saponins	Decoction and powder
13.	*Aloe vera* L.	Liliaceae	Sotru Kattraazhai	H	Whole plant	Cultivated, ornamental and wild	NE	**Whole plant** – i)Peeled leaves are eaten to sore throat and coughs ii) Leaf gel helps digestion, improve blood circulation, kidney problems and constipation	Anthraquinone	Juice, tonic and powder
14.	*Alternanthera sessilis* (Linn.) R. Br. ex DC.	Amaranthaceae	Ponnonkanni keerai	H	Whole plant and root	Wild	LC (2018)	**Whole plant** – Bronchitis, asthma, hair tonic, menstrual disorders and skin diseases **Root**– Fever and bloody dysentery	Alkaloids and steroids	Paste and juice
15.	*Argyreiapomacea* Choisy.	Convolvulaceae	Mustai	C	Root	Wild	NE	**Root** – Jaundice and kidney problems	Alkaloids and phenols	Extraction
16.	Aristolochia indica L. BHVCW 18	Aristolochiaceae	Adagam	C	Root, leaves and seeds	Cultivated	NE	**Root** – Gastric stimulant **Leaves**– Cough **Seeds**– Inflammation and biliousness	Alkaloids, triterpenoids, steroids and sterols	Juice
17.	*Aristolochia tagala* Cham.	Aristolochiaceae	Aadutheen-dapalai	CS	Leaves and roots	Wild	NE	**Leaves**– Fever, swollen limbsand skin diseases **Roots**– Carminative and applied to abdomen	Kaempferol	Powder and Juice
18.	*Artocarpus hirsute* Lamk. BHVCW 19	Moraceae	Murasabalam	T	Seed and fruit	Cultivated and wild	NE	**Seed and fruit** – Asthma and skin diseases	Glycosides, alkaloids and tannins	Powder
19.	*Arundo donax* L.	Poaceae	Korukkai	H	Root and stem	Cultivated, ornamental and wild	LC (2012)	**Root** – Diuretic, emollient, stimulate menstrual discharge and headaches	Alkaloids and tannins	Infusion and paste

								Stem – Broken limbs		
20.	*Asparagus racemosus* Willd.BHVCW 22	Liliaceae	Sataavari-Kizhangu	C	Whole plant and root	Wild	NE	**Whole plant** – Rheumatism, diabetes and brain complaints **Root** – Dysentery	Steroids and saponins	Tonic
21.	*Bacopa monnieri* (L.) Penn.	Scrophulariaceae	Brammi	H	Whole plant	Wild	LC (2012)	**Whole plant**– Indigestion, ulcers, wind, constipation, asthma, bronchitis and infertility	Steroids, saponins and alkaloids	Juice
22.	*Barleria buxifolia* L.	Acanthaceae	Rosmullip-puntu	S	Leaves	Wild	NE	**Leaves**– Respiratory diseases, toothache and joint pains	Phenols, flavonoids and glycosides	Extraction
23.	*Buchanania lanzan* Spr.	Anacardiaceae	Saaraappa-ruppu	T	Leaves, roots and fruits	Cultivated and wild	NE	**Roots**– Cooling, constipating and diarrhea **Leaves**– Skin diseases **Fruits** – Coughs and asthma	Flavonoids	Decoction, powder and tonic
24.	*Cadaba fruticosa* (L.) Druce. BHVCW 30	Capparidaceae	Vizhuthi	S	Leaves and roots	Cultivated and wild	NE	**Leaves**– Cold, dysentery and various internal disorders **Roots**– Coughs and rheumatism	Alkaloids	Juice
25.	*Canavalia cathartica* Thouars.	Fabaceae	Kattukozhia-varai	CS	Whole plant	Cultivated, ornamental and wild	NE	**Whole plant** – Peptic ulcer	Flavonoids, alkaloids and glycosides	Tonic
26.	*Cansjera rheedii* Gmel.	Opiliaceae	Kalimanak-keerai	CS	Whole plant	Wild	NE	**Whole plant** – Used in treating post-natal pain, fever, poisonous bites and skin diseases	Phenolic compounds	Paste
27.	*Capparis divaricata* Lam. BHVCW 32	Capparidaceae	Thoratti	T	Leaves and bark	Cultivated and wild	NE	**Leaves and bark** – Ulcer, dysentery and stomach problem	Alkaloids and flavonoids	Paste and tonic
28.	*Capparis grandiflora* Hook.f. & Thomson. BHVCW 33	Capparidaceae	Mudkondai/ Thorattimul	S	Whole plant, leaves and fruit	Wild	NE	**Fruit** – Stomach ache **Whole plant** – Gastralgia, vomiting and abdominal pain **Leaves**– Stomachic, diuretic, anti-rheumatic, shortness of breath and antitumor	Flavonoids, glycosides, terpenes and alkaloids	Decoction and juice
29.	*Capparis grandis* L. f.	Capparidaceae	Pachara	T	Bark and leaves	Cultivated	NE	**Bark and leaves**– Ulcer, asthma and swelling	Alkaloids	Tonic and juice
30.	*Capparis sepiaria* L. BHVCW 34	Capparidaceae	Sengathaari	S	Root and whole plant	Cultivated and wild	***NE***	**Whole plant**– Stomachache, fevers, inflammations and diseases of muscles **Root** –Skin diseases and snake	Alkaloids, glycosides, terpenes, sterols and	Decoction

								bite	flavonoids	
31.	*Capparis zeylanica* L.	Capparidaceae	Adhandai/Sud uthoratti	S	Rootbark and leaves	Wild	NE	**Rootbark** – Used as cooling, vomiting, sedative and stomachic **Leaves**– Used to treat boils, swellings and piles	Flavonoids and alkaloids	Decoction
32.	*Caralluma umbellate* Haw.	Asclepiadaceae	Erumaikalli-mulayan	H	Stem	Cultivated and wild	NE	**Stem** – Stomach disorder, abdominal pain, obesity, diabetes and ulcer problems	Alkaloids, tannins,flavonoids and phenols	Juice
33.	*Cardiospermum halicacabum* L. BHVCW 35	Sapindaceae	Mudakkattan	C	Whole plant and root	Cultivated, ornamental, wild	LC (2020)	**Whole plant**– Diuretic, rheumatism, stomachache, nervous diseases and snakebite **Root** – Catarrh of the bladder and urinary tract	Tannins, alkaloids, flavonoids and saponins	Juice
34.	*Carissa carandas* L. BHVCW 36	Apocynaceae	Kallakai	S	Root and leaves	Cultivated, ornamental and wild	NE	**Leaves**– Fever, diarrhea and earache **Root** – Stomach ache, vermifuge and skin itching	Steroids, terpenes, tannins, flavonoids and alkaloids	Decoction
35.	*Cassia leschenaultiana* DC.	Caesalpiniaceae	-	US	Leaves and stem	Cultivated and wild	NE	**Leaves and stem** – Constipation, cold, fever, intestinal disorder and skin diseases	Flavonoids	Juice and decoction
36.	*Cassia tomentosa* Willd.	Caesalpiniaceae	-	S	Leaves	Cultivated and wild	NE	**Leaves**– Eczema, intestinal parasites and skin diseases	Anthraquinones and triterpenoids	Infusion and tonic
37.	*Cayratia pedata* Juss. BHVCW 40	Vitaceae	Kattuperandai	CS	Whole plant and leaves	Wild	VU (2014)	**Leaves**– Astringents and anti-arthritis **Whole plant**– Coughs, bronchitis, asthma and joint pain	Alkaloids, steroids, tannins, phenols, flavonoids and terpenoids	Extraction and decoction
38.	*Ceropegia juncea* Roxb.	Asclepiadaceae	Jaathili	CH	Leaves	Cultivated and ornamental	NE	**Leaves**– Bacterial infection, ulcer and inflammation	Alkaloids	Decoction and juice
39.	*Citrullus colocynthis* (L) Schrad. BHVCW 44	Cucurbitaceae	Varikuramathai	H	Fruits, seeds and roots	Cultivated and wild	NE	**Roots** – Jaundice, rheumatism and urinary diseases **Fruits and seeds**– Diabetes	Alkaloids and saponins	Powder and pickles
40.	*Commelina benghalensis*	Commelinaceae	Adutinnathalai	H	Whole plant,	Wild	LC (2018)	**Leaves**–Diarrhoea **Root**– Stomach disorders	Alkaloids	Decoction

	L.BHVCW 49				root and leaves			**Whole plant**– Eye ailments,sore throat and burns		
41.	*Dalbergia latifolia* Roxb.	Fabaceae	Nukkam	T	Bark	Cultivated and wild	VU (1998)	**Bark** – Indigestion, leprosy and vermifuge	Glycosides and alkaloids	Extraction
42.	*Decalepis hamiltonii* W. & A.	Asclepiadaceae	Magalie	C	Tuber	Cultivated and wild	EN (2014)	**Tuber** –Wound healing, fever, bronchial and asthma	Glycosides and phenols	Tonic
43.	*Diospyros melanoxylon* Roxb.	Ebenaceae	Karai	T	Bark, flowers , seeds and fruits	Cultivated and wild	NE	**Fruits**– Cooling and astringent **Flowers**– Skin and blood diseases **Bark** –Diarrhoea **Seeds**– Mental disorders and palpitations	Steroids, alkaloids and glycosides	Decoction
44.	*Diospyros Montana* Roxb.	Ebenaceae	Bankini	T	Whole plant and fruits	Wild	NE	**Fruits**– Treat boils **Whole plant** – Fever and pneumonia	Polyphenol s and alkaloids	Decoction and paste
45.	*Dodonaea viscose* L. BHVCW 60	Sapindaceae	Virali	S	Stems, leaves, roots and bark	Ornamental and wild	LC (2018)	**Stems**– Rheumatism **Roots**– Colds, indigestion, ulcers, diarrhea, constipation and irregular menstruation **Bark**– Astringent **Leaves**– Used to treat swellings, inflammations, burns and wounds	Saponins and tannins	Decoctionand infusion
46.	*Dysoxylum malabaricum* Bedd.	Meliaceae	Vellaiyagil	T	Wood	Wild	EN (2014)	**Wood**– Arthritis, cardiac debility, expelling intestinal worms, leprosy, inflammation and rheumatism	Alkaloids	Decoction and paste
47.	*Elaeagnus conferta* Roxb.	Elaeagnaceae	Kolaga	S	Fruits and flowers	Cultivated and wild	LC (2018)	**Fruits and flowers** – Used to treat sores and ulcers	Alkaloids, sterols and flavonoids	Decoction
48.	*Emilia zeylanica* Cl.	Asteraceae	-	H	Whole plant	Cultivated and wild	LC (2010)	**Whole plant**–Cough, gonorrhea and diuretic	Alkaloids, terpenoids and flavonoids	Paste and decoction
49.	*Euphorbia antiquorum* L.	Euphorbiaceae	ChaturaKalli	T	Wood, root bark and latex	Cultivated, ornamental and wild	NE	**Rootbark**– Purgative and induce vomiting **Latex**– Rheumatism, toothache, earache and asthma **Wood** – Dysentery, dropsy and toothache	Flavonoids and triterpenoi ds	Tonic

50.	*Evolvulus nummularius* BHVCW 64	Convolvulaceae	Elikkathuillai	H	Whole plant	Cultivated and ornamental	NE	**Whole plant**– Cure burns, cuts, wounds and scorpion stings	Alkaloids, saponins and tannins	Paste
51.	*Ficus arnottiana* Miq.	Moraceae	Kodiuarasu	T	Bark and leaves	Cultivated	NE	**Leaves**– Used for controlling fertility **Bark**– Astringent, diabetes, inflammation, skin diseases,burning sensation, leprosy, scabies and wounds	Sterols and alkaloids	Infusion and paste
52.	*Ficus benjamina*L.	Moraceae	Pimpri	T	Leaves and barks	Ornamental and wild	LC (2018)	**Bark** – Curing liver diseases **Leaves**–Wounds and bruises **Leaves and bark**– Rheumatism and headaches	Tannins	Juice
53.	*Ficus carica* L.	Moraceae	Simaiyattai	T	Leaves and fruit	Cultivated	LC (2007)	**Leaves**– Stomach ache and swollen piles **Fruit**– Laxative, demulcent, piles, insect stings and bites	Alkaloids, tannins, glycosides and flavonoids	Decoction and tonic
54.	*Grewia flavescens* Juss.	Tiliaceae	Semparandai	T	Roots	Wild	LC (2018)	**Roots** – Menstrual problems and stomach problems	Alkaloids and glycosides	Infusion
55.	*Grewia villosa* Willd.	Tiliaceae	Jenukallai	S	Roots and bark	Wild	LC (2019)	**Roots** – Body pains **Bark** – Wounds, syphilis and smallpox	Alkaloids	Decoction
56.	*Harpullia arborea* (Blanco) Radlk.	Sapindaceae	NeiKottei	T	Bark and seeds	Ornamental and wild	LC (2018)	**Seeds** – Rheumatism **Bark** – Allay pain	Saponins	Infusion
57.	*Heliotropium curassavicum* L.	Boraginaceae	-	H	Whole plant and roots	Wild	LC (2015)	**Roots**– Sores and wounds **Whole plant**–Leucorrhoea	Alkaloids	Decoction and powder
58.	*Hemidesmus indicus* R.Br. BHVCW 71	Asclepiadaceae	Nannari	C	Root	Cultivated and wild	NE	**Root** – Blood purifier, demulcent, diuretic, dyspepsia, fever, skin diseases, chronic coughs, swellings and rheumatic joints	Coumarin, sterols, saponins, glycosides, tannins and flavonoids	Paste and tonic
59.	*Hydrolea zeylanica* Vahl.	Hydrophyllaceae	Vellel	H	Leaves	Semi – cultivated and wild	LC (2010)	**Leaves**– Wound healing, ulcers and diabetes	Alkaloids	Decoction
60.	*Indigofera linnaei* Ali.	Fabaceae	Sheppunerunji	H	Whole plant	Wild	NE	**Whole plant**– Diuretic and venereal affections	Alkaloids and saponins	Juice
61.	*Indigofera trita* L.f. BHVCW 72	Fabaceae	Punal-murunkai	H	Whole plant	Ornamental and wild	LC (2010)	**Whole plant**– Liver disorders and tumours	Phenols and	Tonic

									flavonoids	
62.	*Ipomaea aegyptia* L.	Convolvulaceae	-	C	Leaves	Ornamental and wild	NE	**Leaves**– Fever, burns and cough	Glycosides	Decoction
63.	*Ipomaea aquatica* Forsk.	Convolvulaceae	Neerpasalai	C	Leaves androots	Cultivated	NE	**Leaves**– Cough, fever, boils and sores **Roots** – Laxative, piles and antidote	Phenols and flavonoids	Decoction, tonic and paste
64.	*Kickxia elatine* (L.) Dumort.	Scrophulariaceae	-	H	Whole plant	Wild	NE	**Whole plant** – Wound healing and bleeding	Flavonoids	Tonic
65.	*Leonotis nepetaefolia* R.Br. BHVCW 83	Lamiaceae	-	H	Whole plant and leaves	Cultivated, ornamental and wild	NE	**Whole plant**– Swellings, fever, gastro-intestinal troubles and used as a wash for piles **Leaves**– Skin diseases, wounds and pneumonia	Flavonoids, alkaloids, saponins and terpenoids	Decoction, infusion, tonic and juice
66.	*Lepidagathis scariosa* Nees.	Acanthaceae	Nyamdutiet	H	Leaves	Cultivated and wild	NE	**Leaves**– Woundsand pneumonia	Terpenoids and alkaloids	Infusion
67.	*Leptadenia reticulata* W&A.	Asclepiadaceae	Palaikkodi	CS	Leaves androots	Wild	NE	**Leavesand roots**– Skin infections and wounds **Roots**– Cardiac disease, diuretic and to cure fever	Tannins, phenols and alkaloids	Decoction, paste and juice
68.	*Lindernia caespitosa* (Blume) G. Panigrahi.	Scrophulariaceae	-	H	Whole plant	Wild	LC (2010)	**Whole plant**– Dysentery and other intestinal problems	Alkaloids	Decoction and juice
69.	*Lippia nodiflora* Mich.	Verbenaceae	Poduthalai	H	Whole plant and root	Ornamental and wild	LC (2018)	**Whole plant**–Astringent, carminative, diuretic, coughs, constipation, pain in the knees, fevers and colds **Root** – Gastric troubles	Alkaloids, phenols and tannins	Paste, juice and infusion
70.	*Ludwigia perennis* L.	Onagraceae	Neerkara-yambu	H	Stem	Wild	LC (2010)	**Stem** – Aching gums, fever and cough	Alkaloids	Paste and tonic
71.	*Mollugo oppositifolia* L. BHVCW 90	Aizoaceae	Thurapoondu	H	Whole plant	Wild	LC (2019)	**Whole plant** – Stomachic, antiseptic and cure skin diseases	Alkaloids, saponins and terpenoids	Extraction and juice
72.	*Mollugo pentaphylla* L. BHVCW 91	Aizoaceae	-	H	Whole plant, roots and leaves	Wild	NE	**Whole plant**– Laxative, antiseptic and stomachic **Leaves**– Used to treat mouth infections and sore legs **Roots** – Eye diseases	Alkaloids and steroids	Decoction
73.	*Mundulea sericea* (Willd.) A. Chev.	Fabaceae	Vellai	S	Leaves and roots	Cultivated, ornamental and wild	LC (2018)	**Leaves**– Poisonous bitesand emetic **Roots** – Infertility	Alkaloids,glycosides, flavonoids	Infusion

									and phenols	
74.	*Neptunia oleracea* Lour.	Mimosaceae	Sundaikkirai	H	Root and stem	Cultivated and wild	LC (2018)	**Root**– Necrosis and syphilis **Stem**– Earache	Flavonoids, triterpenoids and tannins	Juice
75.	*Opuntia dillenii* Haw.	Cactaceae	MulluKalli	S	Fruit	Cultivated and wild	LC (2009)	**Fruit** – Diabetes	Alkaloids	Juice
76.	*Opuntia monacantha* Haw.	Cactaceae	Chappathikalli	S	Fruit	Cultivated and wild	LC (2010)	**Fruit**– Diabetes, inflammation and ulcers	Alkaloids, tannins and saponins	Juice
77.	*Oxystelma esculentum* R.Br. BHVCW 96	Asclepiadaceae	Oosippalai	C	Leaves	Cultivated	LC (2011)	**Leaves**– Cough and joint pain	Alkaloids, anthraquinones and flavonoids	Juice
78.	*Pandanus odoratissimus* Roxb.	Pandanaceae	Kaitha	ST	Leaves and roots	Cultivated, ornamental and wild	NE	**Leaves**– Diuretic and treat boils **Roots**– Diuretic and depurative	Alkaloids and glycosides	Tonic
79.	*Passiflora foetida*L. BHVCW 97	Passifloraceae	Mupparisavalli	CS	Whole plant, stem and leaves	Cultivated and wild	NE	**Whole plant**– Tuberculosis, worms, coughs and colds **Leaves and stem**– Improve fertility in women **Leaves**–Wound of a snake bite	Alkaloids, phenols, glycosides and flavonoids	Decoction, juice and infusion
80.	*Polygonum glabrum* Willd.	Polygonaceae	Paregudi	H	Root and stem	Cultivated	LC (2010)	**Root and stem** – Piles, jaundice and constipation	Terpenoids	Decoction
81.	*Pongamia pinnata* (L.) Pierre. BHVCW 102	Fabaceae	Pungamaram	T	Seed, leaves and root	Cultivated, ornamental and wild	LC (2010)	**Seed** – Bronchitis, whooping cough and sores **Leaves**– Rheumatism, cough and skin diseases **Root**– Sores and ulcers	Alkaloids	Decoction, infusion, juice, tonic and powder
82.	*Psilotrichum nudum* Moq. BHVCW 105	Amaranthaceae	-	H	Leaves	Cultivated and wild	NE	**Leaves**– Asthma, cold and fever	-	Extraction
83.	*Pterocarpus marsupium* Roxb.	Fabaceae	Vengai	T	Leaves and bark	Cultivated, ornamental and wild	NT (2017)	**Bark**– Astringent, diarrhea and diabetes **Leaves**– Boils, sores and skin diseases	Alkaloids and tannins	Decoction or powder
84.	*Pterolobium hexapetalum* (Roth.) Santapau & Wagh.	Caesalpiniaceae	Indumullu	CS	Root and leaves	Cultivated, ornamental and wild	NE	**Leaves**– Tuberculosis and respiratory diseases **Root**– Stomach ache, snakebites and infertility	Tannins	Decoction, infusion and juice

	BHVCW 106									
85.	*Rubus fruticosus* L.	Rosaceae	-	S	Leaves and roots	Wild	NE	**Roots**– Dysentery, sore throat and wounds **Leaves**– Astringent and mouth ulcers	Alkaloids and flavonoids	Decoction and tonic
86.	*Scutia myrtina* Kurz.	Rhamnaceae	Tuvadi	S	Fruit	Cultivated and wild	LC (2018)	**Fruit** – Astringent	Alkaloids and glycosides	Decoction
87.	*Sterculia urens* Roxb.	Sterculiaceae	Kavalam	T	Gum	Cultivated and wild	NE	**Gum**– Laxative and throat infections	Alkaloids	-
88.	*Striga lutea* Lour.	Scrophulariaceae	Pallipoondu	H	Whole plant	Wild	NE	**Whole plant** – Intestinal parasites	Alkaloids, flavonoids and tannins	Decoction
89.	*Tylophora asthmatica* W. & A. BHVCW 124	Asclepiadaceae	Naypalai	C	Root	Wild	NE	**Root**– Asthma, bronchitis, dysenteryand stomachic	Alkaloids, tannins and glycosides	Decoction
90.	*Vanda tessellate* Hk. BHVCW 125	Orchidaceae	Kantanakuli	E	Roots	Cultivated, ornamental and wild	LC (2013)	**Roots**– Dyspepsia, bronchitis, inflammations, piles, rheumatism and scorpion stings	Flavonoids, tannins, saponins, phytosterol s and alkaloids	Decoction
91.	*Viscum album* L.	Loranthaceae	-	SP	Leaves and stem	Cultivated, ornamental and wild	NE	**Leavesand stem** – Breast cancer, diuretic and high blood pressure	Alkaloids	Tonic
92.	*Wrightia tinctoria* R.Br.	Apocynaceae	Irum-paalai	T	Bark, seeds, roots and leaves	Ornamental and wild	LC (2019)	**Bark** – Dysentery and dropsy **Seeds**–Intestinal worms, diarrhea, dysentery and fevers **Leaves**– Toothache **Leavesand roots**– Fever **Bark and leaves**–Stomach painsand psoriasis	Glycosides	Paste and tonic
93.	*Xylia xylocarpa* Taub.	Mimosaceae	Iruvel	T	Bark and seeds	Cultivated and wild	LC (2018)	**Bark**– Astringent, leprosy, vomiting, diarrhea and ulcers **Seeds**– Rheumatism, piles and leprosy	Tannins	Decoction
94.	*Zizyphus mauritiana* Lamk.	Rhamnaceae	Illandai	T	Fruits, seed, leaves and root	Cultivated, Semi-cultivated and wild	NE	**Fruits**– Purify the blood &aid digestion, bronchitis and anemia **Seed**– Stomach ache, insomniaand night sweats **Root**– Fever, wounds and ulcers **Leaves**– Promote hair growth	Saponins, triterpenes, tannins, flavonoids and alkaloids	Decoction and tonic

** Kritikar and Basu (1935); Khare (2007); Chopra et al. (1956, 1969); Parrotta (2001)*

FERNS								
S. No.	**Botanical Name**	**Family Name**	**Local Name**	**Habit**	**Parts Used**	**Cultivation Status**	**Ecological Status**	**Therapeutic Uses**	**Mode of Preparation**
1.	*Actiniopteris radiata* (Sw.) Link.	Pteridaceae	Fan leaf Fern	H	Whole plant	Ornamental and wild	NE	**Whole plant –** Astringent and malarial fevers	Decoction
2.	*Adiantum lunulatum* Burm.f.	Pteridaceae	Walking Maidenhair Fern	H	Whole plant and roots	Ornamental and wild	NE	**Whole plant –**Diuretic, fever and coughs **Root –**Fever, elephantiasis and throat affections	Decoction
3.	*Cheilanthes mysorensis* Wall.	Adiantaceae	Dwarf Hairy Lip Fern	H	Leaves	Wild	NE	**Leaves –**Antidiabetes, high pressure and fever	Decoction
4.	*Drynaria quercifolia* (Linn.) J. Sm.	Polypodiaceae	Oak-leaf fern	H	Rhizome	Wild	NE	**Rhizome –** Astringent, typhoid, dyspepsia and coughs	Tonic
5.	*Hemionitis cordata* Roxb.	Hemionitidaceae	Heartleaf fern	H	Leaves	Wild	NE	**Leaves –** Anti diabetes and anti-inflammation	Decoction
6.	*Marsilea minuta* L.	Marsileaceae	Dwarf water clover fern	H	Whole plant and leaves	Wild	LC (2018)	**Whole plant–** Increase fertility **Leaves –** Indigestion, nose bleeding and reduce swelling	Juice
7.	*Microlepia speluncae* (L.) T. Moore	Dennstaedtiaceae	Limp leaf fern	H	Leaves	Wild	NE	**Leaves –**Wound healing and burns	Paste

BRYOPHYTES		
S.No.	**Botanical Name**	**FamilyName**
1.	*Riccia cordifolia*	Ricciaceae
LICHENS		
S.No.	**Botanical Name**	**FamilyName**
1.	*Dirinaria sps.*	Caliciaceae
2.	*Parmotrema sps.*	Parmeliaceae

***Note:H** – Herb, **S** – Shrub, **C** – Climber, **T** – Tree, **CS** – Climbing Shrub, **E** – Epiphyte, **SP** – Semi-Parasite, **US** – Under Shrub, **CH** – Climbing Herb, **ST** – Small Tree; **NE** – Not Evaluated, **LC** – Least Concern, **EN** – Endangered, **VU** – Vulnerable, **NT** – Near Threatened*

The survey indicated that the study area was rich in medicinal plants used as therapeutics to treat a wide range of human illnesses. Some of the common health ailments in the study area are skin diseases, rheumatism, joint pain, bronchitis, piles, asthma, hypertension, diarrhea, antidote for scorpion sting, fever, cough, cold, toothache, jaundice, wounds, etc. Presumably, the availability of such plants in the locality may increase the use of plants as medicine. Medicinal plants contain a wide variety of secondary metabolites or compounds and it is belief that active principles are helpful in herbal preparation and responsible for their beneficial effects. The majority of formulations were prepared as decoction (46) followed by a juice (28) and tonic (23) (Fig. 5). It was seen that decoction, juice and infusion were used to treat ailments internally (cold, cough, jaundice, ulcer and diabetics).

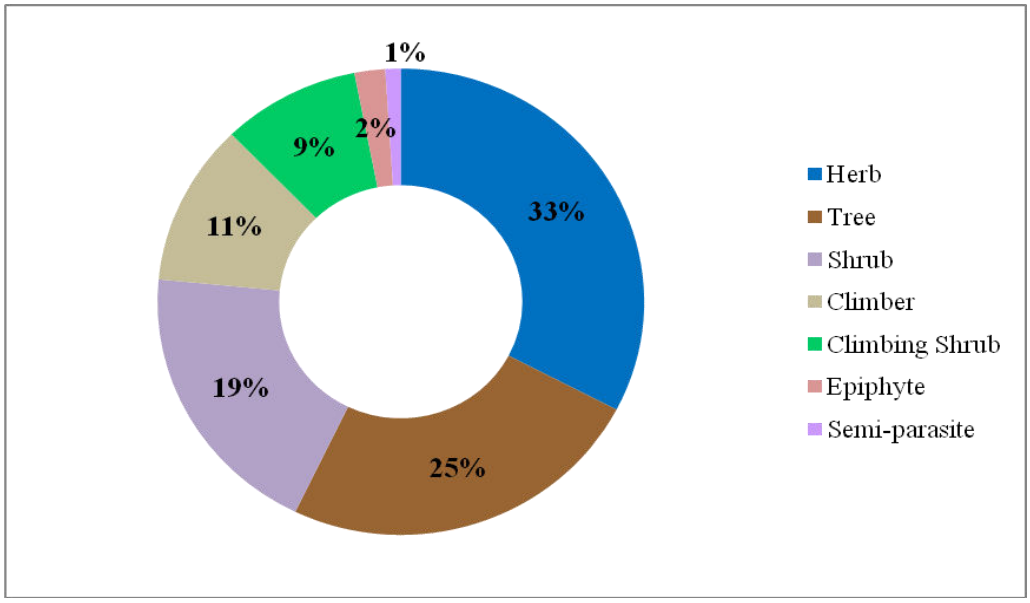

Fig. 3: Graphical presentations of habit-wise analysis for surveyed medicinal plants

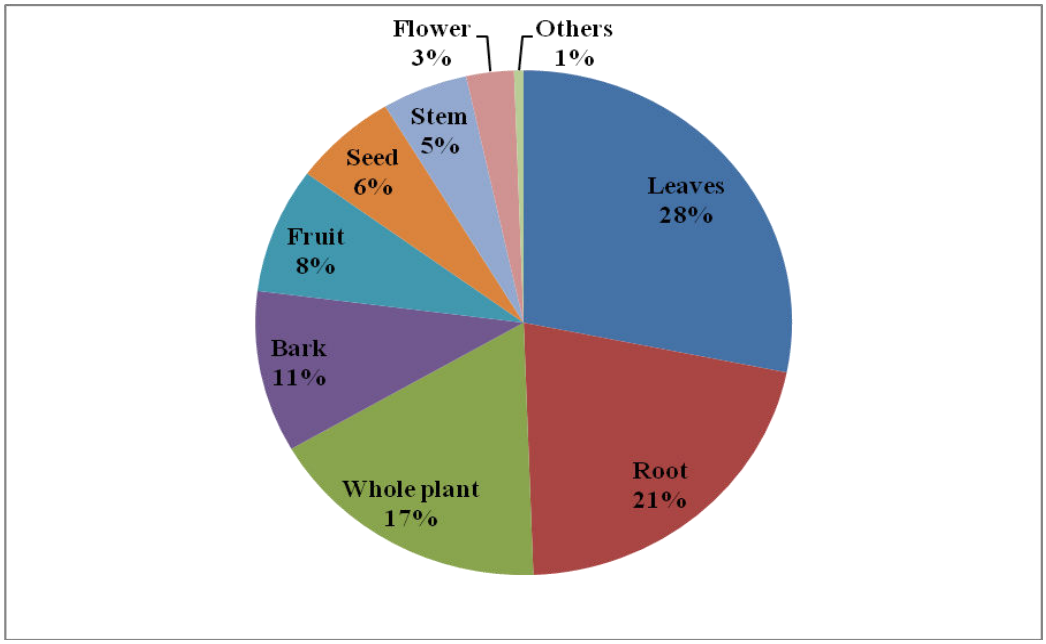

Fig. 4: Percentage of different parts used by Irula tribes for medicine preparation

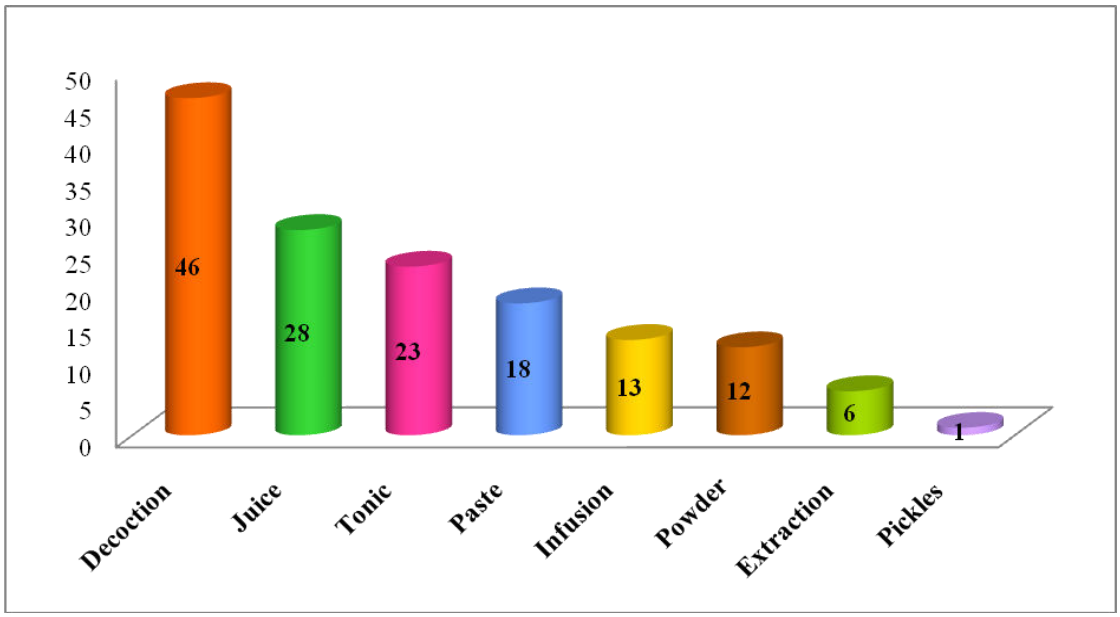

Fig. 5: Histogram showing the mode of preparation for surveyed medicinal plants

4. DISCUSSION

The study reveals that tribes in the region rely upon plants for therapeutic purposes. During the present investigation, 104 species using medicinal purposes were gathered. The families like Fabaceae, Mimosaceae and Asclepiadaceae with 7% are dominant over other families. Out of them,32 were herbs, 24 shrubs, 19 trees and 11 climbers. Plant parts utilized as a source of medication was in the range of organized to unorganized sources. In most of the cases leaves (28%) were used for curing ailments followed by roots (21%), whole plants (17%), bark (11%), fruits (8%), seeds (6%), stems (5%), flowers (3%) and other parts (1%). Similar recordings regarding the plant habitats were reported [14-16].

In this study, the documented plant species were compared with previous literatures and classified as wild, cultivated and ornamental for the conservation status of these plant species. A similar observation was also reported [17].

The IUCN used to define the categories of threatened plant species has been refined considerably from time to time (IUCN 2020). It is important to know whether it represents a precise gauge of the proportion of threatened plants in the Indian flora. The plant list has been checked with their distribution and threatening status included in Red Data Book [18].

The information on medicinal uses of the plant species compared with some important literatures and books of Indian Medicinal Plants viz. Kirtikar and Basu (1935), Chopra *et al*. (1956, 1969), Khare (2007), Parrotta (2001) and searched with the help of the website Useful Tropical Plants Database 2014.

Therapeutic properties of these medicinal plants were due to the presence of different secondary metabolites like alkaloids, terpenoids, glycosides, phenols and others. It is believed that active principles are helpful in herbal preparations and responsible for their beneficial property. Among these alkaloids, phenols, terpenoids and glycosides were the important chemical compounds [25].

Generally, a fresh part of the plant is used for the preparation of medicine [26]. The methods of preparation mainly fall into the following categories, viz. decoction (46%), juice extracted from the fresh plant parts (28%), tonic (23%), plant parts applied as a paste (18%) and powder made from fresh or dried plant parts (12%). In the surveyed plants, a few plants are used alone and a few plants are used in combination. These findings were similarly related to Ohemu *et al*. (2014) and concluded as decoction and maceration are the most common mode of preparation.

5. CONCLUSION

The result of the present investigation gives evidence that therapeutic plants continue to play a vital role in the healthcare system. A total of 104 plant species represented by 86 genera and 52 families were documented for medicinal purposes. The majority of the plant species have more than one medicinally

important part. The literature survey has indicated that most of the medicinal plants reported in the present study have scientific validation. The recorded medicinal plants can serve as a database for forthcoming work or scientific validation. Moreover, this study opens the door to the scientific approach, which could prompt the discovery of new drugs, with lesser side effects. The information assembled from the tribal practitioners is valuable for researchers in the field of ethnobotany, ethnomedicine, taxonomy and pharmacology for further studies. The present investigation shows that Manar hills have great diversity of medicinal plants with rich ethnomedicinal uses to treat various disorders.

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Conflicts of interest

The authors proclaim that they have no conflicts of interest concerning this article.

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