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In silico validation of the indigenous knowledge of the herbal medicines among tribal communities in Sathyamangalam wildlife sanctuary, India

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ABSTRACT

The ethno-botanical documentation among ethnic people in Sathyamangalam wildlife sanctuary, Tamil Nadu, India has been investigated for the first time. A total of 61 medicinal plants having new combination uses were reported with adjuvant in the treatment of dermatological, Genitourinary and gastrointestinal ailments. This study could help in the recovery and conservation of traditional medicine system among educated generation. The present study was aimed to: (1) documentation of the traditional knowledge (2) quantitative analysis using Use value (UV), Informant consensus factor (ICF), Index of agreement on remedies (IAR), Relative frequency citation (RFC) and Cultural Importance index (CII) (3) validation of ethno-botanical data using *in silico* biological activity and toxicity prediction studies. Semi-structured direct interviews were conducted to acquire information from the study area tribes. Total of 89 tribes including both gender among various communities were interviewed and their ethno-botanical knowledge was documented. The data were assessed using ethno-botanical indices methods to estimate the consistency of usage herbal knowledge in various ailments. A total of 61 species were recorded for treatment of categorized ailments. The collected medicinal information from ethnic groups shows remarkable new usage of medicinal plants to particular ailments. Our comparative *in silico* studies also supported the traditional medicine results with correspondence to their bioactive. Traditional knowledge of ethnic people also linked to their culture and history. This study also infers the usage of traditional plant based medicine. Further research related to the bioactivities of reported plants should be encouraged to explore the importance in pharmaceutical industry.

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1. Introduction

Indigenous knowledge is the neighbourhood information acquired by indigenous groups that is exceptional to an ethnic society. The scientific investigation and documentation of indigenous knowledge of plant resources are vital strategy to understand traditional life style of local ethnic people.¹ The traditional herbal formulations from indigenous knowledge were considered as the oldest and great health care system. It includes plant species as regular medicine sources and still is an important system of

healthcare in India.² Common plants with adverse effects are being a part of our daily life and their toxic metabolites are closely related in the aspect of human's health condition.³ Traditional people are using poisonous plants either processed or as raw form over a period of time for treating diseases.⁴

The increasing interest in ethno-botanical studies also reveals their importance of traditional medicinal plants in various countries for local living holds and the important role these play in health care system.^{2,5} The impact of traditionally formulated medicines from various ancient systems in the communal health condition in India is considerably elevated and is closely associated with traditions.⁶ Various patented drugs and active compounds from various plant sources are also on the basis of ethno-botanical data.⁷

The ethno-botanical data analyzed with quantitative indices is assumed to expose the usage and value of the medicinal plants

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from ethnic knowledge. These approaches measure the consent of the usage by various hypotheses and playing an important role in the further selection of biomedical analysis of a medicinal plant to treat particular ailment based on the survey results with excellent information.⁸ Now days, *In silico* studies are one of the main emerging studies with the ability to predict the drug-protein interaction which relates the mechanism of action of a bioactive compounds mainly from traditional medicinal plants.⁹

So, there is an urgent requirement to document all ethno-botanical data as much as possible and the role of tribes in conserving them. Considering the importance of indigenous medicinal plant knowledge, this study aimed to identify potential medicinal plants and to evaluate *in silico* toxicological potential and biological activity of its major compounds responsible for medicinal activity.

2. Materials and methods

2.1. Study area tribal people

Sathyamangalam wildlife sanctuary located in the Nilgiri biosphere reserve covers about 1411.6 km² (545.0 sq mi) forest area along the Western Ghats in Tamil Nadu, India (Fig. 1). This forest is mostly tropical dry forest and restricted to undersized high altitude hill tops between 750 and 1649 m above mean sea level and the slopes and plains are subjected to the average minimum and maximum temperatures of 21–27 °C with two persistent rivers namely Bhavani and Moyar. Uralis are the main ethnic group to this forest with some minor groups includes Soliga, Malayalee and Naicker communities.

2.2. Data collection

The field surveys were conducted between May 2015 and September 2016 in proposed study area and various ethnic community people were randomly interviewed after verbally requested about the purpose of the project in the local language. In this study, 89 informants including traditional herbalist and local people were interviewed and their knowledge on medicinal plants was gathered and documented mostly by Tamil and sometime the Urali language was translated to Tamil using local translator.

2.3. Botanical identification

The collected plants were identified with help of pertinent literature and also authenticated by comparing the species deposited in Madras Herbarium (Botanical Survey of India, Coimbatore). The processed specimens were mounted on herbarium sheets using standard procedures and were deposited for future reference at the Department Herbarium of Bharathiar University.

2.4. Ethno-medicinal data analysis

The recorded data were tabulated using Microsoft Excel and then analyzed with various ethno-botanical reports such as research and review articles, books, in scientific databases to find out the uses of unknown or well-known medicinal plants. The ethno-medicinal quantitative indices were used for interpreting this entire information.

Use reports were calculated by converting collected data with reference to the previous published articles related to quantitative ethno-botanical surveys. These use-reports about medicinal plants were then grouped into 14 ailments categories based on the collected ethno-botanical details from informants. These data were assessed with quantitative indices, such as Informant consensus

factor, Fidelity level, Frequency citation and Use value, were calculated from the gathered information. The new medicinal uses from the study area are identified by comparing previous reports on the particular area and related regions of south India.

2.4.1. Informant consensus factor (ICF)

ICF was calculated to highlight the usage of the relevant plants among various informants for each ailments category. The ICF value was calculated by minus the total use citations in each category (Nur) with the total number of species used (nt), divided by the total number of use citations minus one as follows:

$$ICF = (Nur - Nt) / (Nur - 1)$$

The ICF value of approach to 0 indicates that the informants randomly use the species in the treatment of various ailments, and a value of approach to 1 indicates that relatively usage of the species by a large population to a particular ailment.¹⁰

2.4.2. Fidelity level (FL) and index of agreement on remedies (IAR)

The importance of each species in the treatment of particular illness group was determined by FL and IAR values. A high ratio indicates common use of the ideal plant species for treating specific ailment in the studied area.¹¹ The fidelity level was calculated as follows:

$$FL (\%) = (Np/N \times 100)$$

The FL is the ratio of number of informants who suggesting the plant as medicine for a particular ailment category (Np) and total number of informants who suggesting the plant for any ailment category (N).

$$IAR = (Nr - Na) / (Nr - 1)$$

Where, Nr is the total number of citations registered for a particular species and Na is the number of illness categories that are treated with this species.

2.4.3. Frequency citation (FC) and relative frequency citation (RFC)

The relative expression of usage (FC) is calculated as follows:

$$FC = (\text{Number of times a particular species was mentioned} / \text{total number of times that all species were mentioned}) \times 100$$

The RFC value was obtained by dividing the FC by the total number of informants interviewed (N) and not based on used categories. When the RFC value will be approach to zero, it refers, nobody suggests the plants as useful, and when its approach to one, it refers that every informant would suggest as useful and the RFC was calculated as follows:¹²

$$RFC = FC/N$$

2.4.4. Use value (UV) and Cultural importance index (CII)

The importance of each plant species among ethnic people was determined by UV and CII.¹² Based on, the vast usage of a particular ethnically important medicinal plant species was identified using CII value. The use value of a species (UV) is the summation of the number of use reports for the specific plant species (U) and is divided by the total number of informants (N) interviewed. If the use value is high, it indicates the many use reports and important of the plant, and low value indicates the fewer use reports. These were calculated as follows

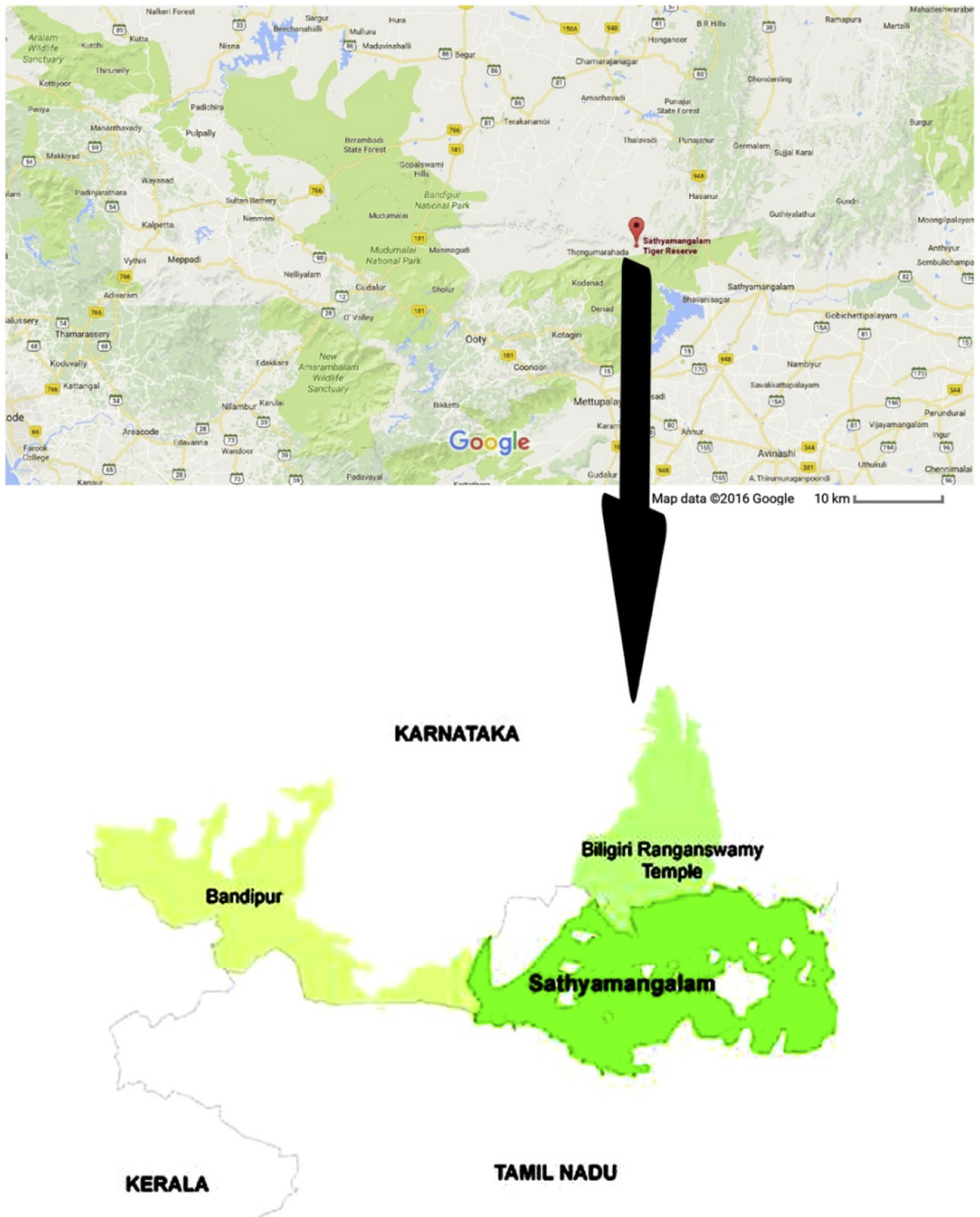


Fig. 1. Study area.

$$UV = \sum UR/N$$

$$CII = \sum_{u=1}^{unc} \sum_{i=1}^{in} \frac{UR_i}{N}$$

Where NC is the total number of different illness categories for each species, UR is the total number of use citations for each species, and N is the number of informant's interviewed. The ethno-botanical indices such as ICF, UV, RFC and FL could be used to determine the consent individual species in the treatment of an ailment category in a population.

2.5. In silico pharmacological activity and toxicity prediction

The present study employed online based computational bioactive screening (PASS) to obtain biological effects and relationship for compounds which are previously reported on plants major ethno-botanical uses in the study area.¹³ The details about the compounds including structure, SMILES and molecular formula were obtained from ACS Chemspider. Probable activity (Pa) and inactivity (Pi) percentages (ranges from 0.000 to 1.000) were used to express the prediction results. Thus, in this study the higher Pa value (>0.900) and lower Pi value indicates higher activity. The adsorption, distribution and toxicity of the listed compounds were predicted by using admetSAR online prediction tool.

3. Results

3.1. Demographical description and documentation of ethno-botanical data

The ethnic people population was found limited in the study area, 89 of informants including male (58) and female (31) of various different age groups (ranges from 31 to 80 years) including 6 herbalists age ranges between 40 and 60 years belonging to the local communities were interrogated (Table 1). The collected data was divided and tabulated according to the corresponding 55 bio-medical symptoms into 14 major ailment categories (Tables 2 and 3) respectively to the local term used. When compared to all major ailments categories gastrointestinal ailments had reported with high number of citations (375 citations of 22 plants) which was followed by dermatological (333 citations of 19 plants) and genitourinary ailments category (222 citations of 9 plants) respectively (Table 3). The gastrointestinal (36%) and dermatological ailment category (31%) (Fig. 2) were cited as most treating ailments in the survey. A total of 61 plants species and 54 genera distributed over 23 families with various beneficial effects cited in the present study, particularly 15% of Fabaceae and 10% of Rutaceae (Fig. 3). The usage of different parts of medicinal plant used in traditional medicine were calculated in percentage, among various parts used the leaf showed highest (51%), followed by seeds, fruit, stem and rhizome

Table 1
Demographic representation of informants by age group in Sathyamangalam wild-life sanctuary, India.

Age group of informants (In years)	Local people		Herbalists
	Male (58)	Female (31)	
31–40	28	16	
41–50	15	5	4
51–60	9	8	2
61–70	4	2	
71–80	2		

Table 2

List of ailments category with its corresponding tamil terms used by the tribes in Sathyamangalam wildlife sanctuary, Tamil Nadu, India.

S. No	Ailment category and Biomedical terms	Tamil terms
1	Circulatory system ailments Anemia Heart problem Cardio tonic Blood tonic	Raththa soagai Idhaya pirachanai Idhaya valimai Raththa perukki
2	Dermatological ailments Burns Itch Wounds Rash Inflammation Skin disease Mouth ulcer Leprosy Skin lotion Bacterial and fungal diseases	Theekkaayam Namaichaal Kaayam Sori Udaleritchal Tholnoikal Vaaippun Thoalunoi Sarumamarunthu Thotranoi
3	Ear, nose, throat ailments Gums ache Earache	Eeralvali Kathu vali
4	Eye ailments Eye diseases	Kannoikal
5	Endocrinal ailments Diabetes	Sakkara/Neerilivunoi
6	Fever ailments Fever	Kaachal
7	Gastrointestinal ailments Dysentery Indigestion Vomiting Stomach ache Stomach ulcer Abdominal pain Digestion disorders Gas trouble Intestinal disorders Diahroea	Vayitruoakku Ajeeranam Vaandhi Vayitruvali Vayitruvali Adi Vayitruvali Jeeranam kolarugal Vaaivuthoandharuvu Kudalkoalaarugal Neerpokku
8	Genitourinary ailments Bladder infection Diuretic Urinary disorders Kidney stone Leucorrhoea Venereal diseases Jaundice Liver diseases Abortion	Siruneerppaithotru Siruneerperukki Siruneerkoalaarugal Siruneer kalladappu Vellaipaduthal Paalvinainoikal Manjalkaamalai Kalleeralnoikal Karukallaipu
9	Hemorrhoids ailments Piles	Moolam
10	Neurology ailments Headache	Thalaivali
11	Oncology ailments Cancer	Katti
12	Poisonous bites ailments Snake bite Scorpion sting	Paambu kadi Thel kadi
13	Respiratory ailments Asthma Cold Cough Breathing problem Small pox	Kaasa noi Sali Irumal Moochu thinaral Sitrammai
14	Skeletal muscular ailments Edema Joint pain Body pain Rheumatism/Gout Swelling Muscle pain Arthritis Paralyze	Neer veekkam Moodu vali Udal vali Keel vaadham Veekam Thasai pidippu Moodu vali Mudakkuvadm

Table 3

Results obtained from informants belongs to Sathyamangalam wild life sanctuary, Tamil Nadu, India.

S. No	Family/ Binomial name	Vernacular name	Parts Used ^a	Method of preparation	Ailments treated	Administration route ^b	Total number of citation	UV	IAR	FC (%)	RFC
1	Annonaceae <i>Annona squamosa</i> L.	Seetha maram	L	Juice	Diabetes (14)	O	44	0.49	0.98	49.44	0.56
2	Asteraceae <i>Spilanthes calva</i> Wt.	Vettumarunthuchedi	L	Paste	Abortion (30)	T	20	0.22	1	22.47	0.25
3	<i>Spilanthes acmella</i> Murr.	Manjapoochedi	F	Paste	Gums ache (7)	T	7	0.08	1	7.87	0.09
4	<i>Tridax procumbens</i> L.	Mookuthichchedi	L	Juice, Paste	Wound (9)	O	9	0.10	1	10.11	0.11
5	<i>Eclipta prostrata</i> (L.)	Karisilanganni	S, L, Wp	Dried Powder	Head ache (6) Abdominal pain (13)	T/O	28	0.31	0.93	31.46	0.35
6	Fabaceae <i>Abrus precatorius</i> L.	Kundumani	Se, L	Decoction Powder	Stomach ulcer (25) Abortion (20)	O	71	0.80	0.96	79.78	0.90
7	<i>Bauhinia divaricata</i> L.	Aathi	L	Extract	Dysentery (6)	I	24	0.27	0.96	26.97	0.30
8	<i>Bauhinia tomentosa</i> L.	Aathi	B	Paste	Fever (15)	O	21	0.24	1	23.60	0.27
9	<i>Prosopis juliflora</i> (Sw.) DC.	Vannimaram	L, B	Juice	Asthma (9)	O/T	16	0.18	1	17.98	0.20
10	<i>Pongamia pinnata</i> (L.) Pierre	Pungamaram	Fl	Paste	Diahorrea (21)	O	23	0.26	0.91	25.84	0.29
11	<i>Canavalia cathartica</i> Thouars	Isaakottai	L	Dried	Snake bite (6) Diabetes (8)	O	9	0.10	1	10.11	0.11
12	<i>Tephrosia purpurea</i> (L.) Pers.	Kolinjii	R	Powder	Body pain (5) Muscle pain (4)	O	9	0.10	0.88	10.11	0.11
13	<i>Clitoria ternatea</i> L.	Sangupushpam	L	Juice	Fever (5)	O	35	0.39	1	39.33	0.44
14	<i>Sesbania grandiflora</i> (L.) Poir.	Agathimaram	L	Cooked	Indigestion (4)	O	43	0.48	0.98	48.31	0.54
15	Apocyanaceae <i>Plumaria alba</i> L.	Ezhakalari	B, R	Paste	Dysentery (28) Indigestion (7)	O	41	0.46	0.98	46.07	0.52
16	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Sarpaganthi	L	Decoction	Indigestion (10) Dysentery (25)	O	14	0.16	1	15.73	0.18
17	<i>Wrightia tinctoria</i> R.Br.	Pallayamaram	B	Juice	Eye diseases (8)	T	18	0.20	1	20.22	0.23
18	Rutaceae <i>Aegle marmelos</i> (L.) Correa	Vilvam	F, L, B	Paste	Cancer (12)	O	57	0.64	0.95	64.04	0.72
19	<i>Citrus aurantiifolia</i> (Christm.) Swingle	Elumiccai	F	Decoction	Venereal diseases (9)	O	49	0.55	0.98	55.06	0.62
20	<i>Citrus limon</i> (L.) Osbeck	Kicilippalam	L, F	Raw	Urinary disorders (20)	O	33	0.37	1	37.08	0.42
21	<i>Toddalia asiatica</i> Lamk.	Masihachedi	B	Paste	Heart problem (5) Cardio tonic (9)	O/T	15	0.17	1	16.85	0.19
22	<i>Murraya paniculata</i> (L.) Jack	Sedisil maram	L	Paste	Itch (5)	T	20	0.22	1	22.47	0.25
23	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Molehulukki	R	Paste	Rash (3)	O	15	0.17	1	16.85	0.19
24	Lamiaceae <i>Vitex negundo</i> L.	Nochi	L	Juice	Wounds (10)	O	39	0.44	0.97	43.82	0.49
25	<i>Ocimum basilicum</i> L.	Thiruneetrapachhai	L	Raw	Fever (20)	I	25	0.28	1	28.09	0.32
26	<i>Leucas aspera</i> (Willd.) Link	Thumbai	Wp	Juice	Cold (13)	I	20	0.22	1	22.47	0.25
27	Euphorbiaceae <i>Euphorbia hirta</i> L.	Ammaan pachcharsi	Wp	Decoction	Fever (6)	O	28	0.31	1	31.46	0.35
28	<i>Euphorbia nivulia</i> Buch.-Ham.	Illaikanni	L	Powder	Blood tonic (8) Cancer (10)	T	14	0.16	1	15.73	0.18
29	<i>Jatroba curcas</i> L.	Kattaamankku	B	Juice	Stomach ache (29) Blood tonic (20)	O	19	0.21	1	21.35	0.24
30	<i>Phyllanthus amarus</i> L.	Keeva nelly	R, F	Paste	Indigestion (20) Vomiting (13)	O	34	0.38	1	38.20	0.43
31	<i>Acalypha indica</i> L.	Kuppaimeni	L	Paste	Paralyze (15)	T	65	0.73	0.98	73.03	0.82
32	Asclepiadaceae <i>Calotropis gigantea</i> (L.) Dryand.	Vellai erukku	R	Paste	Asthma (25)	T	37	0.42	0.97	41.57	0.47
33	<i>Calotropis procera</i> (Aiton) Dryand.	Erukku	L	Paste	Head ache (20)	T	30	0.34	1	33.71	0.38
34	<i>Hemidesmus indicus</i> (L.) R. Br. ex Schult.	Nannari	L	Powder	Leucorrhoea (28)	I/O	40	0.45	0.97	44.94	0.50
35	<i>Pergularia daemia</i> (Forssk.) Chiov.	Vellyparuthi	L	Decoction	Head ache (20)	I	20	0.22	1	22.47	0.25

(continued on next page)

Table 3 (continued)

S. No	Family/ Binomial name	Vernacular name	Parts Used ^a	Method of preparation	Ailments treated	Administration route ^b	Total number of citation	UV	IAR	FC (%)	RFC
36	Solanaceae <i>Solanum xanthocarpum</i> Schrad	Kandangkathhiri	F L	Cooked Paste	Intestinal disorders (10) Small pox (23)	O/T	33	0.37	0.97	37.08	0.42
37	<i>Solanum nigrum</i> L.	Chukuti chedi	L F	Cooked	Mouth ulcer (12) Intestinal disorders (19)	O	31	0.35	0.97	34.83	0.39
38	<i>Solanum indicum</i> L.	Mullu chundal	F	Cooked	Intestinal disorders (12)	O	12	0.13	1	13.48	0.15
39	<i>Datura metal</i> L.	Oomathai	L	Paste	Joint pain (14) Rheumatism/Gout (15)	T	29	0.33	1	32.58	0.37
40	Malvaceae <i>Sida acuta</i> Burn.	Kala karandai	L	Paste	Skin disease (23) Burns (10) Wounds (12)	T	45	0.51	1	50.56	0.57
41	<i>Abutilon indicum</i> (L.) Sweet	Thuthi	Wp, L	Cooked Paste	Piles (10) Inflammation (15) Dysentery (9)	O	34	0.38	0.94	38.20	0.43
42	Acanthaceae <i>Andrographis paniculata</i> (Burm.f.) Nees	Periya nangai	L	Paste Juice	Joint pain/ Rheumatism (12) Gout (5) Swelling (4) Arthritis (8) Leprosy (8) Indigestion (10)	O/T	47	0.53	0.96	52.81	0.59
43	<i>Justicia adhatoda</i> L.	Adathodai	L	Decoction	Cold (9) Cough (10) Breathing problem (7)	O	26	0.29	1	29.21	0.33
44	<i>Ruellia patula</i> Jacq.	Puni chedi	L	Paste	Fever (10)	T	10	0.11	1	11.24	0.13
45	Pedaliaceae <i>Sesamum indicum</i> L.	Ellu	Se, L	Powder Paste	Abortion (30) Diuretic (13) Wound (8)	O/T	51	0.57	0.98	57.30	0.64
46	Myrtaceae <i>Psidium guajava</i> L.	Koyyamaram	L	Paste	Indigestion (11)	O	11	0.12	1	12.36	0.14
47	<i>Syzygium cumini</i> L.	Navalmaram	F, L	Powder	Diabetes (20)	O	20	0.22	1	22.47	0.25
48	Oxalidaceae <i>Oxalis corniculata</i> L.	Pulichikeerai	L, R	Cooked Paste	Blood tonic (10) Fever (10)	O	20	0.22	0.95	22.47	0.25
49	Nyctaginaceae <i>Boerhavia diffusa</i> L.	Saranda kodi	Wp	Paste	Digestive disorder (9) Urinary tract infection (11) Bladder infection (6)	O	26	0.29	0.96	29.21	0.33
50	Convolvulaceae <i>Ipomea obscura</i> (L.) Ker.-Gawl	Shiruttallai	Sl	Juice	Wound (6) Fever (5)	T	11	0.12	0.9	12.36	0.14
51	<i>Evolvulus alsinoides</i> L.	Vishnukarandai	L	Paste	Burn (6) Wound (8)	T	14	0.16	1	15.73	0.18
52	<i>Rivea hypocrateriformis</i> (Desr.) Choisy	Minna chedi	L	Cooked	Indigestion (7)	O	7	0.08	1	7.87	0.09
53	Rubiaceae <i>Haldina cordifolia</i> (Roxb.) Ridsdale	Manja Kadambai	B	Paste	Anemia (8) Urinary disorders (12)	O	20	0.22	0.95	22.47	0.25
54	<i>Rubia cordifolia</i> L.	Chevvali kodi	L	Paste	Scorpion sting (9)	T	9	0.10	1	10.11	0.11
55	Oleaceae <i>Jasminum angustifolium</i> (L.) Willd.	Kattu malligai	L	Juice	Diahrroea (8)	O	8	0.09	1	8.99	0.10
56	Poaceae <i>Saccharum officinarum</i> L.	Karumppu	S	Juice	Rash (5)	T	5	0.06	1	5.62	0.06
57	Mimosoideae <i>Acacia nilotica</i> (L.) Delile	Karuvelam	L	Paste	Wound (6) Piles (3) Cough (5)	O/T	13	0.15	0.83	14.61	0.16
58	Menispermaceae <i>Cocculus hirsutus</i> (L.) Diels	Kattukodi	L	Paste	Blood tonic (6) Piles (4) Dysentery (8) Diabetes (2)	O	20	0.22	0.84	22.47	0.25
59	<i>Tinospora sinensis</i> (Lour.) Merr.	Seenthal kodi	L	Powder	Burn (10) Edema (12)	T	22	0.25	0.95	24.72	0.28
60	Zingiberaceae <i>Zingiber officinale</i> Roscoe	Injii	Rh	Paste Powder	Head ache (6) Abdominal pain (10) Gums ache (11) Digestive disorder (6) Indigestion (7)	T/O	40	0.45	0.92	44.94	0.50
61	Sapindaceae <i>Cardiospermum halicacabum</i> L.	Thatu putu chedi	L	Paste	Joint pain (8) Arthritis (10) Asthma (12) Swelling (4) Burn (8) Body pain (12)	T/O	54	0.61	0.96	60.67	0.68

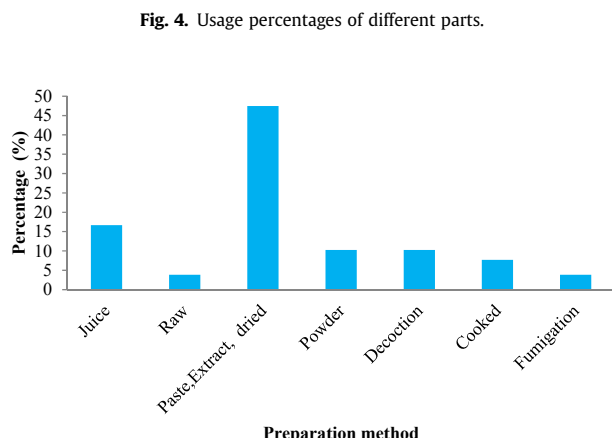
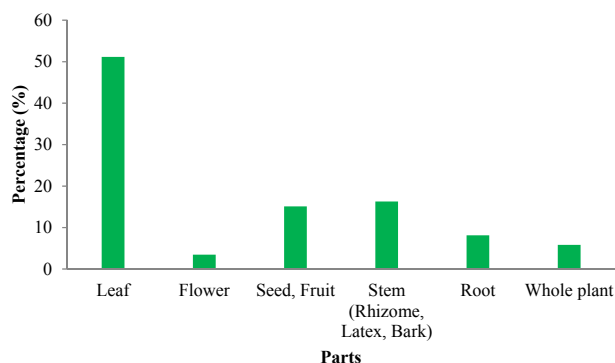
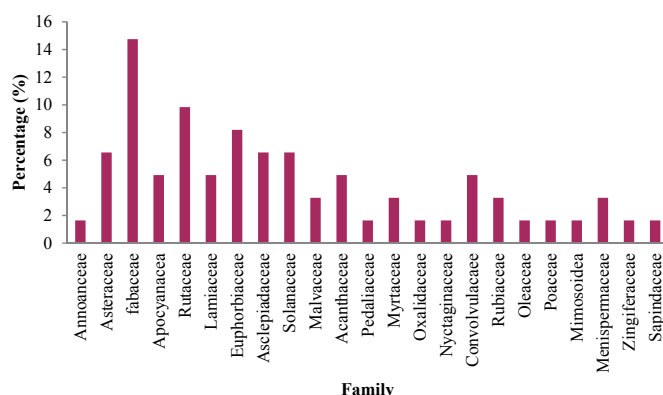
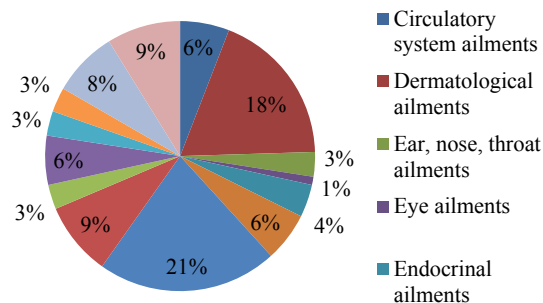
^a B- bark, L-leaf, S-stem, Se-seed, Fl-flower, F-fruit, R-root, Rh-rhizome, Wp-whole plant, Sl-stem latex.

^b O- oral, T-topical, I- inhalation.

(ranges between 15 and 16%), and finally flowers (3%) with the lowest among all parts used (Fig. 4). In the studied area there were two modes are normally prescribed for administration either oral or topical in various forms such as juice, paste, cooked, decoction, etc. The paste preparation method (including extract and dried form) is the most used preparation method (47%) followed by powder and decoction (Juice) is ranges between 10 and 17% (Fig. 5).

3.2. Quantitative analysis of ethno-botanical indices

Plants with 20 or more than citations were considered as frequently cited plants and indicated by RFC which was ranges from 0.09 to 0.90 (Table 3). These plants can be explained by their reliable medicinal source among informants of studied area. In the present study, the highest number of citations was for *Abrus*



precatorius L. (71 citations with RFC 0.90) used in the treatment of gastrointestinal, dermatological and oncological ailments, followed by *Acalypha indica* L. (65 citations with RFC 0.82) and *Aegle marmelos* (L.) Correa (57 citations with RFC 0.72). The higher RFC indicates the more citation (at least 40 out of 89 interviewed informants) and implies the most common medicinal plants among the tribes of Sathyamangalam wildlife sanctuary. The relative use of particular medicinal plant for treating an ailment category was highlighted by ICF value. Based on the calculated ICF values (ranges from 0.88 to 1.00) the ailments are further categorized into Higher, Moderate and Lower ICF value ailments. The eye ailment category shows highest ICF value (1.00) with 8 reports of 1 species and genitourinary (0.96), skeletal-muscular (0.96), gastrointestinal (0.96) and dermatological (0.95) ailments are also categorized as high ICF value ailments category. The moderate and lowest ICF values were observed for diseases of the circulatory system ailments (0.92) followed by Hemorrhoids ailments (0.88) (Table 4). This high value indicates the homogeneity of ethno-medicinal knowledge between the informants. Medicinally significant plant was determined by FL it was calculated for the entire ailment category and tabulated (Table 4). Hemorrhoids, oncology and eye ailments are reported as categories consists lower FL (<50) than other ailments. Among 14 listed ailment categories 11 ailments at least have one plant had the highest FL (100%) particularly dermatological and gastrointestinal ailments were reported with high number of FL 100% plants (8 respectively). The individual with most use-reports was considered as common medicine for a particular ailment treatment. Based on the use-reports collected from ethnic people CII, UV and IAR indices were calculated to highlight the usage priority, importance, recommendation and sharing medicinal knowledge about the particular species among the informants. In this study *Abrus precatorius* L. (CII-3.191, UV-0.80, IAR-0.96), *Aegle marmelos* (L.) Correa (CII-2.562, UV-0.64, IAR-0.95), *Cardiospermum halicacabum* L. (CII-1.820, UV-0.61, IAR-0.96), *Andrographis paniculata* (Burm.f.) Nees (CII-1.584, UV-0.53, IAR-0.96), *Zingiber officinale* Roscoe (CII-1.348, UV-0.45, IAR-0.92) and *Acalypha indica* L. (CII-1.461, UV-0.73, IAR-0.98) were showed commendable values this indicates the importance of the species among the studied area tribes (Tables 3 and 4). Among 61 recorded medicinal plants from the studied area, 19 plants revealed new use reports which were identified by comparing previous reported literature (Table 5). The local names of the cited plants were almost same among all community in the study area indicates the homogeneity and relevance of particular individual species in herbal medicine.

Based on the ethno-botanical uses and literature review the components of the 22 medicinal plants and their pharmacological activities were studied to validate the traditional use by *in silico* study. The biological spectrum analysis (PASS online) used to reveal the correlation between the activities of structural properties of bioactive compounds (Table 7). Previously, *Andrographis paniculata* (Burm.f.) Nees was used ethnically in the treatment of skeletal ailments but the predicted biological spectrum (PASS) results of reported compounds revealed these could acts as best hepatic agent (Pa-0.964) and anti-allergic (Pa-0.721) (Table 6). The admetSAR online prediction was also done to predict the absorption, metabolism and toxicity of the listed compounds of medicinally important species (Table 5). From the results all the reported compounds were considered as they can easily metabolized, absorbed and transported through human intestinal [Example spilanthol, oleanolic acid, ramnazin-3-O-rutinoside, 2,4,8,9-tetrahydroxy-6H-(1)benzofuro(3,2-c)chromen-6-one, torvoside A,

Table 4

ICF value for the illness category and FL and CII values for the reported plants in Sathyamangalam wildlife sanctuary, Tamil Nadu, India.

S. No	Illness category	Number of citation (Nur)	Number of species cited (Nt)	ICF FL% and CII
Illness with High ICF value				
1	Eye ailments	8	1	1.00 <i>Sesbania grandiflora</i> (L.) Pers. (19/0.966)
2	Genitourinary ailments	222	9	0.96 <i>Haldina cordifolia</i> (Roxb.) Ridsdale (60/0.449) <i>Boerhavia diffusa</i> L. (65/0.584) <i>Sesamum indicum</i> L. (84/1.146 ^a) <i>Phyllanthus amarus</i> Schumach. & Thonn. (100/0.382) <i>Euphorbia hirta</i> L. (100/0.315) <i>Plumaria alba</i> L. (71/0.921) <i>Abrus precatorius</i> L. (28/3.191 ^a) <i>Annona squamosa</i> L. (68/0.989 ^a) <i>Eclipta prostrata</i> (L.) L. (32/0.944)
3	Skeletal muscular ailments	179	9	0.96 <i>Cardiospermum halicacabum</i> L. (63/1.820 ^a) <i>Tinospora sinensis</i> (Lour.) Merr. (55/0.494) <i>Andrographis paniculata</i> (Burm.f.) Nees (62/1.584 ^a) <i>Datura metel</i> L. (100/0.326) <i>Calotropis gigantea</i> (L.) Dryand. (46/0.831 ^a) <i>Acalypha indica</i> L. (28/1.461) <i>Vitex negundo</i> L. (67/0.876 ^a) <i>Toddalia asiatica</i> (L.) Lam. (100/0.169) <i>Canavalia cathartica</i> Thouars (100/0.101)
4	Dermatological ailments	333	19	0.95 <i>Spilanthes calva</i> DC. (100/0.225) <i>Tridax procumbens</i> (L.) L. (100/0.101) <i>Abrus precatorius</i> L. (17/3.191) <i>Wrightia tinctoria</i> R.Br. (100/0.202) <i>Murraya paniculata</i> (L.) Jack (100/0.225) <i>Acalypha indica</i> L. (88/1.461 ^a) <i>Calotropis gigantea</i> (L.) Dryand. (54/0.831 ^a) <i>Calotropis procera</i> (Aiton) Dryand. (100/0.337) <i>Solanum nigrum</i> L. (39/0.697) <i>Sida acuta</i> Burm.f. (100/0.506) <i>Abutilon indicum</i> (L.) Sweet (43/1.146) <i>Andrographis paniculata</i> (Burm.f.) Nees (17/1.584) <i>Sesamum indicum</i> L. (16/1.146) <i>Ipomoea obscura</i> (L.) Ker Gawl. (55/0.247) <i>Evolvulus alsinoides</i> (L.) L. (100/0.157) <i>Saccharum officinarum</i> L. (100/0.056) <i>Acacia nilotica</i> (L.) Delile (46/0.438) <i>Tinospora sinensis</i> (Lour.) Merr. (45/0.494) <i>Cardiospermum halicacabum</i> L. (16/1.820)
Illness with moderate ICF value				
5	Ear, nose, throat ailments	32	3	0.94 <i>Zingiber officinale</i> Roscoe (28/1.348) <i>Euphorbia nivulia</i> Buch.-Ham. (100/0.157) <i>Spilanthes acmella</i> (L.) L. (100/0.079)
6	Neurology ailments	85	6	0.94 <i>Zingiber officinale</i> Roscoe (15/1.348) <i>Hemidesmus indicus</i> (L.) R. Br. ex Schult. (50/0.899) <i>Pergularia daemia</i> (Forssk.) Chiov. (100/0.225) <i>Leucas aspera</i> (Willd.) Link (100/0.225) <i>Vitex negundo</i> L. (33/0.876) <i>Eclipta prostrata</i> (L.) L. (21/0.944)
7	Gastrointestinal ailments	375	22	0.94 <i>Eclipta prostrata</i> (L.) L. (46/0.944 ^a) <i>Abrus precatorius</i> L. (44/3.191 ^a) <i>Bauhinia tomentosa</i> L. (100/0.236) <i>Pongamia pinnata</i> (L.) Pierre (39/0.775) <i>Tephrosia purpurea</i> (L.) Pers. (44/0.202) <i>Clitoria ternatea</i> L. (100/0.393) <i>Sesbania grandiflora</i> (L.) Pers. (81/0.966 ^a) <i>Citrus aurantiifolia</i> (Christm.) Swingle (59/1.101) <i>Citrus limon</i> (L.) Osbeck (100/0.371) <i>Jatropha curcas</i> L. (100/0.213) <i>Hemidesmus indicus</i> (L.) R. Br. ex Schult. (50/0.899) <i>Solanum xanthocarpum</i> Schrad. & H. Wendl. (30/0.742) <i>Solanum nigrum</i> L. (61/0.697 ^a) <i>Solanum indicum</i> L. (100/0.135) <i>Abutilon indicum</i> (L.) Sweet (26/1.146) <i>Andrographis paniculata</i> (Burm.f.) Nees (21/1.584) <i>Psidium guajava</i> L. (100/0.124) <i>Boerhavia diffusa</i> L. (35/0.584) <i>Rivea hypocrateriformis</i> Choisy (100/0.079) <i>Jasminum angustifolium</i> (L.) Willd. (100/0.090) <i>Cocculus hirsutus</i> (L.) W.Theob. (67/0.899 ^a) <i>Zingiber officinale</i> Roscoe (58/1.348 ^a)
8	Respiratory ailments	179	9	0.94 <i>Bauhinia divaricata</i> L. (38/0.539) <i>Aegle marmelos</i> (L.) Correa (23/2.562) <i>Glycosmis pentaphylla</i> (Retz.) DC. (100/0.169) <i>Ocimum basilicum</i> L. (100/0.281) <i>Solanum xanthocarpum</i> Schrad. & H. Wendl. (70/0.742 ^a) <i>Justicia adhatoda</i> L. (100/0.292) <i>Acacia nilotica</i> (L.) Delile (38/0.438) <i>Cardiospermum halicacabum</i> L. (22/1.820)
9	Endocrinal ailments	44	4	0.93 <i>Annona squamosa</i> L. (47/0.989 ^a) <i>Pongamia pinnata</i> (L.) Pierre (35/0.775) <i>Syzygium cumini</i> (L.) Skeels (100/0.225) (L.) <i>Cocculus hirsutus</i> (L.) W.Theob. (11/0.899)
10	Fever ailments	71	6	0.93 <i>Ipomoea obscura</i> (L.) Ker Gawl. (45/0.247) <i>Oxalis corniculata</i> L. (50/0.449) <i>Ruellia patula</i> Jacq. (100/0.112) <i>Aegle marmelos</i> (L.) Correa (46/2.562 ^a) <i>Tephrosia purpurea</i> (L.) Pers. (56/0.202) <i>Bauhinia divaricata</i> L. (63/0.539)
11	Oncology ailments	30	3	0.93 <i>Abrus precatorius</i> L. (11/3.191) <i>Plumaria alba</i> L. (29/0.921) <i>Aegle marmelos</i> (L.) Correa (18/2.562)
12	Poisonous bites ailments	31	3	0.93 <i>Rubia cordifolia</i> L. (100/0.101) <i>Pongamia pinnata</i> (L.) Pierre (26/0.775) <i>Prosopis juliflora</i> (Sw.) DC. (100/0.180)
13	Circulatory system ailments	66	6	0.92 <i>Cocculus hirsutus</i> (L.) W.Theob. (43/0.899 ^a) <i>Haldina cordifolia</i> (Roxb.) Ridsdale (60/0.449 ^a) <i>Oxalis corniculata</i> L. (50/0.449) <i>Citrus aurantiifolia</i> (Christm.) Swingle (41/1.101 ^a) <i>Aegle marmelos</i> (L.) Correa (14/2.562) <i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz (100/0.157)
Illness with moderate ICF value				
14	Hemorrhoids ailments	3	3	0.88 <i>Abutilon indicum</i> (L.) Sweet (29/1.146) <i>Acacia nilotica</i> (L.) Delile (23/0.438) <i>Cocculus hirsutus</i> (L.) W.Theob. (25/0.899)

^a Species were considered more consent to treat particular ailment ethno-botanically.**Table 5**

Plants with adverse effects from Sathyamangalam wild life sanctuary, Tamil Nadu, India.

S. No	Binomial name	Adverse effect and interaction
1	<i>Annona squamosa</i> L.	The seed is poisonous. Consuming seed leads to abortion. Sometime used as rat poison
2	<i>Tridax procumbens</i> (L.) L.	Over dosage of leaves leads to ulcer effect.
3	<i>Abrus precatorius</i> L.	Consuming seeds leads to abortion, Hallucination, coma. Consult doctor after consuming
4	<i>Prosopis juliflora</i> (Sw.) DC.	Consumption of fruits of this plant leads to paralysis
5	<i>Plumaria alba</i> L.	Accidental contact of latex of this plant leads to severe skin irritation
6	<i>Wrightia tinctoria</i> R.Br.	Consuming seeds and latex causes ulcer
7	<i>Aegle marmelos</i> (L.) Correa	Over dosage leads to emetic condition
8	<i>Vitex negundo</i> L.	Over dosage leads to gastric disorders
9	<i>Leucas aspera</i> (Willd.) Link	Raw consumption will lead to abortion
10	<i>Jatropha curcas</i> L.	Seed consumption leads to neurotoxic effects
11	<i>Calotropis</i> spp.	The latex causes severe eye and skin irritation
12	<i>Pergularia daemia</i> (Forssk.) Chiov.	Latex leads to skin and eye irritation.
13	<i>Datura metel</i> L.	Accidental consumption of fruits leads to coma, hallucination effects.
14	<i>Sesamum indicum</i> L.	Consumption of seeds leads to abortion
15	<i>Acacia nilotica</i> (L.) Delile	Consumption of seeds leads to vomiting

Table 6

New uses obtained from informants belongs to Sathyamangalam wild life sanctuary, Tamil Nadu, India.

S. No	Binomial name	Medicinal uses from present study	Reported medicinal uses from other studies
1	<i>Eclipta prostrata</i> (L.) L.	Head ache	Liver injuries, jaundice ³²
2	<i>Abrus precatorius</i> L.	Stomach ulcer, Dysentery, Mouth ulcer	Rheumatism, Anti-diabetic, Head ache ³⁵
3	<i>Bauhinia divaricata</i> L.	Asthma	Fever ¹⁴
4	<i>Prosopis juliflora</i> (Sw.) DC.	Snake bite	Poisonous effect ³⁶
5	<i>Pongamia pinnata</i> (L.) Pierre	Abdominal pain, Gas trouble, Snake bite	Diarrhea ³⁷
6	<i>Canavalia cathartica</i> Thouars	Body pain, Muscle pain	Indigestion ¹⁶
7	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Heart problem, Cardio tonic	Blood pressure ³⁸
8	<i>Citrus aurantiifolia</i> (Christm.) Swingle	Stomach ache	Blood tonic ³⁹
9	<i>Toddalia asiatica</i> (L.) Lam.	Paralyze	Stomachic, Anti-pyretic, Diarrhea ⁴⁰
10	<i>Murraya paniculata</i> (L.) Jack	Wounds	Helminthiasis, liver disease ⁴¹
11	<i>Euphorbia hirta</i> L.	Leucorrhoea	Boils, Warts, Ulcers ⁴²
12	<i>Pergularia daemia</i> (Forssk.) Chiov.	Head ache	Acidity ⁴³
13	<i>Andrographis paniculata</i> (Burm.f.) Nees	Leprosy	Dyspepsia, anthelmintic, stomach ache ⁵
14	<i>Evolvulus alsinoides</i> (L.) L.	Burn, Wound	Fever ⁴⁴
15	<i>Rivea hypocrateriformis</i> Choisy	Indigestion	Ethno veterinary important ⁴⁵
16	<i>Haldina cordifolia</i> (Roxb.) Ridsdale	Anemia	Urinary disorders ¹⁴
17	<i>Saccharum officinarum</i> L.	Rash	Gastrointestinal ailments, infertility ⁴⁶
18	<i>Acacia nilotica</i> (L.) Delile	Piles, Cough	Wound healing and sex related ailments ⁴⁴
19	<i>Tinospora sinensis</i> (Lour.) Merr.	Burn wound healing	Insecticides ⁴⁷

β-ionone, umbelliferone and (±)-limonene]. The toxicity profile also reveals the carcinogenicity and cardiogenicity of the identified compounds and the results reveals some non-toxic [(±)-limonene, umbelliferone, procyanidin B1 and spilanthal] and less toxic [4-(β-D-glucopyranosyloxy) benzoic acid, vitexin, (2R,3S,4R,5R,6E)-5-acetamido-2-(acetoxymethyl)-6-(hydroxyimino) tetrahydro-2H-pyran-3,4-diyl diacetate, isoorientin and swertisin] properties of the compounds (Table 6). The remaining herbal species also should be investigated to determine the efficacy and safety evaluation.

4. Discussion

4.1. Demographical description and documentation of ethno-botanical data

Comparing the demographical depiction of the present study with other related studies in nearer area, the average age of local population is close in the studied area.^{14–16} Among the interviewed communal tribes herbalist and traditional healers were also limited in number, it clearly indicates the improper sharing of their knowledge on medicinal plants. The extensive single species usage in herbal treatment was specify the particular medicine for particular symptom which can be used to treat all related symptoms to the same category with some adjuvant like honey, milk, etc.^{17,18} This study also claims some poly herbal combinations can be used in the treatment of various gastrointestinal and dermal associated ailments mainly from Fabaceae and Rutaceae family members. It clearly shows the various bioactive contents responsible for the medicinal properties in Fabaceae and Rutaceae.^{19,20} When compared this medicinal plant (61 plants) diversity of present study with other related regional studies (with 41 and 65 plants) it clearly shows the including of some new reports which are not yet reported.^{14–16} This variation in medicinal plant diversity clearly indicates the influence of nature and climate of selected region of the study area. The use of leaf as common medicinal part to treat various ailments was correlated with several ethno-botanical survey and also support the using of other parts because its well known the plants are the factory of chemicals hence its does not denote the particular parts contain more bioactive than other.²¹ However, the collection of whole plant may be leads to its disappearance from the area and also the collection and abundance of leaf compared with the other parts makes the most using parts in herbal medicine system.²² Oral administration

and paste preparation are most common methods used in Siddha medicinal system and similar results of various surveys also supporting the present study results.^{23,24}

4.2. Quantitative analysis of ethno-botanical indices

This study also proves the importance of ethno medicinal plants in the treatment of genitourinary ailment. The ethnic people have grater medicinal information on indigenous plants. Gastrointestinal system and genitourinary ailment diseases have been reported to have the highest ICF in other surveys and these results indicates the sign of unhealthy lifestyle.^{25,26} Some results from current study also correlated with other surveys carried out in India, such as *Cardiospermum halicacabum* L. (63%), *Solanum nigrum* L. (61%) were mentioned to treat same ailment categories in a reported earlier, however these two reported low FL of 63% and 61% respectively to treat skeletal muscular and gastrointestinal ailments category.²⁷ Three of 14 listed ailment categories i.e. eye, oncology and Hemorrhoids ailments reported with low FL < 50%. But related studies also revealed the activities of *Aegle marmelos* (L.) Correa (18), *Sesbania grandiflora* (L.) Pers. (19) and *Abutilon indicum* (L.) Sweet (29) in the reported uses, it clearly shows the lack of sharing their medicinal knowledge among tribal communities.^{28,29} The higher fidelity level indicates the consent use of these medicinal plants for the treatment of particular ailment by informants of the studied area. However, least CII, UV and IAR values were indicate the limited knowledge of medicinal uses and may be due to its adverse effects of those plants. For example, *Annona squamosa* L. was recorded and reported as anti-diabetic agent,³⁰ despite the fact consuming the fruit may leads to the abortion.³¹ *Eclipta prostrata* (L.) L. used for neurological disorders (headache) by tribes in the present study area. It is also reported to treat Liver injuries and jaundice by the traditional healers of Chithoor district, Andhra Pradesh, India.³² Likewise, there are about 19 species were reported with new uses by comparing with other ethno-botanical studies. This new medicinal information can lead to evaluating active principles to derive new drug molecules.

4.3. Validation of ethno-botanical data using In silico studies

In silico studies are more valuable in ethno botanical research to validate and find potential bioactive compounds which leads in development of new drugs.³³ From the PASS results of listed species

Table 7

In silico validation of important ethno-botanical plants of Sathyamangalam wild life sanctuary, Tamil Nadu, India.

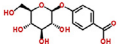
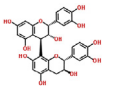
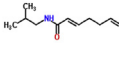
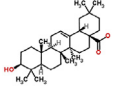
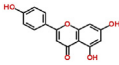
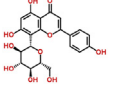
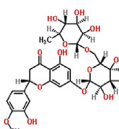
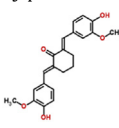
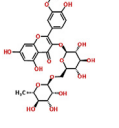
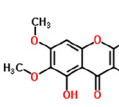
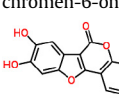
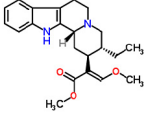
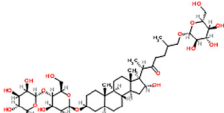
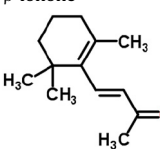
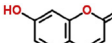
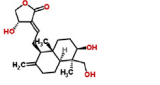
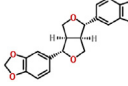
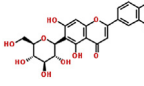
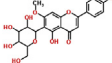
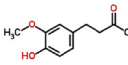
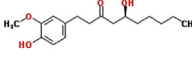
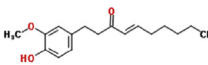
S. No	Binomial name	Ethno uses	Reported pharmacological activities	Reported compounds	PASS prediction		admetSAR prediction ³		
					Predicted bioactivities	Pa	Pi	A	M T
1	<i>Annona squamosa</i> L.	Diabetes Abortion	Anti-diabetic effect, Effects on early pregnancy ⁴⁸	4-(β-D-glucopyranosyloxy)benzoic acid	Anti-diabetic activity	0.988	0.001	+	+++ +
					Antiinfective	0.972	0.002		
				Procyanidin B1	Anti-diabetic activity	0.979	0.001	+++	+++ ND
					Phobic disorders treatment	0.929	0.004		
2	<i>Spilanthes calva</i> DC. and <i>Spilanthes acmella</i> (L.) L.	Wound Gums ache	Vasorelaxant and antioxidant activities ⁴⁹	Spilanthol	Antiseborrheic	0.881	0.006		
					Wound healing	0.820	0.005	+++	+++ ND
					Treatment of anxiety disorder	0.802	0.026		
3	<i>Sesbania grandiflora</i> (L.) Pers.	Eye ailments	Anemia, Bronchitis, Ophthalmia, rheumatism hepatoprotective ⁵⁰	Oleanolic acid	Antidiabetic	0.987	0.001	+++	+++ ND
					Anticancer	0.984	0.002		
					Antinociceptive	0.895	0.001		
					Antineoplastic	0.877	0.005		
					Antiviral	0.836	0.002		
4	<i>Abrus precatorius</i> L.	Stomach ulcer Abortion Dystenry Mouth ulcer Cancer Bacterial fungal infections	Anti-microbial, Abortion ⁵¹	Apigenin	Wound healing	0.963	0.003	+++	+ ND
					Anticancer	0.926	0.002		
					Antimutagenic	0.899	0.003		
				Vitexin	Cardioprotectant	0.950	0.002	+++	+++ +
					Free radical scavenger	0.948	0.001		
					Hepatoprotectant	0.920	0.002		
					Chemopreventive	0.864	0.003		
					Antihemorrhagic	0.826	0.002		
5	<i>Bauhinia tomentosa</i> L.	Diahorrea	Anti diarrhea, anti-inflammatory activity ⁵²	Hesperidin	Free radical scavenger	0.991	0.001	+++	++ ND
					Anticarcinogenic	0.985	0.001		
					Chemopreventive	0.981	0.001		
					Hepatoprotectant	0.977	0.001		
					Antiprotozoal	0.853	0.004		
6	<i>Pongamia pinnata</i> (L.) Pierre	Abdominal pain Gas trouble Snake bite Diabetes	Anti-diabetic ⁵³	Cyqualon	Anticancer	0.927	0.004	+++	++ ND
					Antidiabetic	0.703	0.008		
					Choleretic	0.822	0.003		
7	<i>Acalypha indica</i> L.	Burns Itch Skin lotion Bacterial and fungal diseases Edema	Wound healing, Analgesic, anti-inflammatory ⁵⁴	(2R,3S,4R,5R,6E)-5-Acetamido-2-(acetoxymethyl)-6-(hydroxyimino)tetrahydro-2H-pyran-3,4-diyl diacetate	Transplant rejection treatment	0.936	0.002	++	+++ +
					Antidiabetic	0.856	0.001		
8	<i>Calotropis gigantea</i> (L.) Dryand.	Rash Edema	Wound healing ⁵⁵	Ramnazin-3-O-rutinoside	Free radical scavenger	0.993	0.000	+++	+++ ND
					Cardioprotectant	0.992	0.001		
					Anticarcinogenic	0.987	0.001		
					Antiprotozoal (Leishmania)	0.918	0.003		
9	<i>Vitex negundo</i> L.	Joint pain Head ache	Arthritis ⁵⁶	Casticin	Antimutagenic	0.928	0.002	+++	+ ND
					Free radical scavenger	0.845	0.002		
					Anticancer	0.953	0.003		
10	<i>Eclipta prostrata</i> (L.) L.	Head ache Abdominal pain Jaundice	Antibacterial, Antioxidant, hypolipidemic ⁵⁷	2,4,8,9-Tetrahydroxy-6H-[1]benzofuro[3,2-c]chromen-6-one	Anticancer	0.956	0.003	+++	+++ ND
					Astringent	0.823	0.001		
					Antiseborrheic	0.733	0.031		

Table 7 (continued)

S. No	Binomial name	Ethno uses	Reported pharmacological activities	Reported compounds	PASS prediction		admetSAR prediction ^a		
					Predicted bioactivities	Pa	Pi	A	M T
11	<i>Cocculus hirsutus</i> (L.) W.Theob.	Blood tonic Piles Dysentery Diabetes	Spermatogenic and anti-diabetic activity ⁵⁸	Hirsutine 	Antinociceptive Analgesic Vasodilator	0.814 0.800 0.736	0.002 0.005 0.006	+++ +	ND
12	<i>Solanum</i> spp.	Mouth ulcer Intestinal disorders Small pox	Neuropharmacological activity ⁵⁹	Torvoside A 	Anticancer Hepatoprotectant Antiprotazoal Antineoplastic	0.942 0.902 0.896 0.872	0.002 0.002 0.003 0.005	+++ +++	ND
13	<i>Aegle marmelos</i> (L.) Correa	Fever Cold Blood tonic Cancer	Anticancer ⁶⁰	β -Ionone 	Antineoplastic Dermatologic Antipsoriatic	0.892 0.831 0.786	0.005 0.004 0.004	+++ +++	ND
14	<i>Haldina cordifolia</i> (Roxb.) Ridsdale	Anemia Urinary disorders	Anti-amoebic ⁶¹	Umbelliferone 	Cardiovascular analeptic Antimutagenic Antiseborrheic	0.908 0.898 0.875	0.003 0.002 0.006	+++ +++	ND
15	<i>Citrus aurantiifolia</i> (Christm.) Swingle	Stomachache Blood tonic	Anti-ulcer ⁶²	($\pm$)-Limonene 	Carminative Antieczematic Antineoplastic Chemoprotective	0.961 0.896 0.818 0.781	0.001 0.005 0.010 0.002	+++ +++	ND
16	<i>Andrographis paniculata</i> (Burm.f.) Nees	Skeletal muscular ailments	Anti-inflammatory ⁶³	(-)-Andrographolide 	Choleretic Hepatitis Antineoplastic Antiallergic	0.980 0.975 0.964 0.721	0.001 0.002 0.004 0.007	+++ +++	ND
17	<i>Sesamum indicum</i> L.	Genitourinary ailments	Affecting sex hormones ⁶⁴	Sesamin 	Anticancer Antineoplastic Antidyskinetic Antineurotic Carminative	0.800 0.797 0.742 0.738 0.761	0.005 0.012 0.010 0.030 0.004	+++ +	ND
18	<i>Oxalis corniculata</i> L.	Blood tonic Fever	Cardioprotective ⁶⁵	Isoorientin 	Cardioprotectant Anticancer Hepatoprotectant Antihemorrhagi	0.963 0.922 0.913 0.821	0.002 0.004 0.002 0.002	+++ +++ +	
				Swertisin 	Cardioprotectant Chemopreventive Antineoplastic Antidiabetic	0.957 0.901 0.783 0.769	0.002 0.002 0.014 0.005	+++ +++ +	
19	<i>Zingiber officinale</i> Roscoe	Ear, nose, throat ailments, Neurology ailments	Digestive disorders ⁶⁶	Zingerone 	Antidiabetic Fibrinolytic Antimutagenic	0.920 0.867 0.796	0.003 0.004 0.004	+++ +++	ND
				(+)-[6]-Gingerol 	Preneoplastic treatment Fibrinolytic Vasodilator Antipyretic	0.773 0.758 0.729 0.725	0.004 0.008 0.007 0.004	+++ +++	ND
				Shogaol 	Antimutagenic Antieczematic Mucositis treatment Antiinflammatory	0.851 0.842 0.803 0.732	0.003 0.011 0.013 0.012	+++ +++	ND

(continued on next page)

Table 7 (continued)

S. No	Binomial name	Ethno uses	Reported pharmacological activities	Reported compounds	PASS prediction		admetSAR prediction ^a			
					Predicted bioactivities	Pa	Pi	A	M	T
20	<i>Cardiospermum hellicacabum</i> L.	Skeletal muscular ailments	Anti-arthritis activity ⁶⁷	Arachidic acid 	Anti-diabetic	0.945	0.002	+++	+++	ND
					Phobic disorders	0.939	0.003			
					Mucositis treatment	0.874	0.008			
					Antihypoxic	0.798	0.004			
					Antimutagenic	0.915	0.002	+++	+	ND
					Vasoprotector	0.894	0.003			
					Antihemorrhagic	0.836	0.002			
					Antioxidant	0.717	0.004			
				Luteolin 						

^a A-Absorption, M-Metabolism, T-Toxicity; The scale of ranges from low (+), medium (++) and high (+++) and not detected (ND).

we found that most of the ethno-botanical uses correlate their predicted bioactivities and some compounds targeted as new ligands for particular receptor targets.³⁴ The greater Pa values indicate the binding capacity of the particular compounds as ligands to that respective receptor.³⁴ *In silico* studies combined with traditional knowledge evidently recommend a reasonable efficient background and support in the drug formulation of suitable drug for laboratory testing.

5. Conclusion

From this study, 61 ethno-botanical plants among tribes of Sathyamangalam wildlife sanctuary, were validated and documented through *in silico* for treating various illness categories. The obtained quantitative results (UV, ICF, CII and FL), *in silico* validation and new reports from this study also used to reveal compounds responsible for bio-activities of herbal formulations. This study results also indicates the importance of experience and knowledge about traditional herbal formulation by the tribes in the treatment of various ailments. The present study suggested promoting programs such as digital documentation of traditional knowledge. These could be used to derive some drug development and application of medicinal plants to treat various disorders and also to promote obtains medicine from nature.

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