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Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India

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ABSTRACT

Ethnopharmacological relevance: For thousands of years, medicinal plants have played an important role throughout the world in treating and preventing a variety of diseases. Kani tribal people in Tirunelveli hills still depend on medicinal plants and most of them have a general knowledge of medicinal plants which are used for first aid remedies, to treat cough, cold, fever, headache, poisonous bites and some simple ailments.

Aim of the study: The present study was initiated with an aim to identify traditional healers who are practicing herbal medicine among the Kani tribals in Tirunelveli hills of Western Ghats, India and quantitatively document their indigenous knowledge on the utilization of medicinal plants particularly most common ethnomedicinal plants.

Methods: Field study was carried out over a period of 4 years in Tirunelveli hills. The ethnomedicinal information was collected through interviews among the Kani traditional healers. The collected data were analyzed through use value (UV), informant consensus factor (F_{ic}), fidelity level (FL) and relative importance (RI).

Results: A total of 90 species of plants distributed in 83 genera belonging to 52 families were identified as commonly used ethnomedicinal plants by the Kani traditional healers in Tirunelveli hills for the treatment of 65 types of ailments. These ailments were categorized into 15 ailment categories based on the body systems treated. Leaves were the most frequently used plant parts and most of the medicines were prepared in the form of paste and administered orally. *F*_{ic} values of the present study indicated that there was a high agreement in the use of plants in the treatment of jaundice and diabetes among the users. Dermatological infections/diseases and gastro-intestinal disorders had highest use-reports and 29 species of plants had the highest fidelity level of 100%. The most important species according to their use value were *Gymneme sylvestre* (2.00), *Melia azedarach*, *Murraya koenigii*, *Syzygium cumini* and *Terminalia chebula* (1.83).

Conclusion: As a result of the present study we can recommend the plants Alpinia galanga, Azadirachta indica, Calophyllum inophyllum, Gymnema sylvestre, Leucas aspera, M. azedarach, Mollugo nudicaulis, Ocimum tenuiflorum, S. cumini, T. chebula and Tribulus terrestris (with high UV and RI values), Bambusa arundinacea, Datura metel, Evolvulus nummularius, Opuntia dillenii and Physalis minima (newly reported claims with highest FL) for further ethnopharmacological studies for the discovery of potential new drugs.

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1. Introduction

According to the World Health Organization (WHO) about 65–80% of the world's population in developing countries depends essentially on plants for their primary healthcare due to poverty and lack of access to modern medicine (Calixto, 2005). In recent

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years, use of ethnobotanical information in medicinal plant research has gained considerable attention in segments of the scientific community (Heinrich, 2000). Interest in medicinal plants has been fuelled by the rising costs of prescription drugs in the maintenance of personal health and well-being and the bioprospecting of new plant-derived drugs (Hoareau and DaSilva, 1999).

Historically all medicinal preparations were derived from plants, whether in the simple form of plant parts or in the more complex form of crude extracts, mixtures, etc. The primary benefits of using plant-derived medicines are that they are relatively safer than synthetic alternatives, offering profound therapeutic bene-

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fits and more affordable treatment (Iwu et al., 1999). About 200 years ago our pharmacopoeia was dominated by herbal medicines (Ernst, 2005) and almost 25% of the drugs prescribed worldwide were come from plants. Of the 252 drugs considered as basic and essential by the WHO, 11% are exclusively of plant origin and a significant number are synthetic drugs obtained from natural precursors (Rates, 2001).

During the last few decades there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of India. In the recent years number of reports on the use of plants in traditional healing by either tribal people or indigenous communities of India is increasing (Savithramma et al., 2007; Pattanaik et al., 2008; Kosalge and Fursule, 2009; Namsa et al., 2009; Upadhyay et al., 2010). A few reports on ethnomedicinal uses of plants in the forests of Tirunelveli hills and its adjoining areas were available (Janaki Ammal and Prasad, 1984; Prasad et al., 1987, 1996; Ignacimuthu et al., 1998; Viswanathan et al., 2001; Ayyanar and Ignacimuthu, 2005, 2009a,b, 2010) and all these studies were conducted qualitatively with a lacuna in data analysis. The present study was initiated with an aim to identify knowledgeable resource persons among the Kani tribals in Tirunelveli hills of Western Ghats in Tamil Nadu, India and quantitatively analyze their indigenous ethnomedicinal knowledge through various ethnobotanical tools on the utilization of commonly used medicinal plants.

2. Methods

2.1. Study area and people

Tirunelveli hills occupy Tirunelveli and Kanyakumari districts of Tamil Nadu (southern Western Ghats) and cover an area of nearly 3200 sq. km and lies between $8^{\circ}25'-8^{\circ}53'N$ latitude and $77^{\circ}10'-77^{\circ}35'E$ longitude (Fig. 1). The vegetation is floristically rich compared to other regions of Western Ghats and represents several unique habitats. The study was conducted in five villages of Tirunelveli hills (Agasthiyar Kani kudiiruppu, Chinna Mayilar, Periya Mayilar, Inchikuzhi and Servalar in Tirunelveli district) which are inhabited by Kani tribals each consisting of 5–56 families disbursed in the deep forest areas.

The indigenous people of the study area are Kani or Kanikaran, the oldest group of the branch of ethnic group in South India. They live predominantly in and around the Tirunelveli hills of Tamil Nadu (for details refer Ayyanar and Ignacimuthu, 2005). Many Kani people trace their community's knowledge of medicinal plants back to the Hindu saint and holy man, Agasthiyar Muni, who is credited as the founder of Siddha, the Tamil system of medicine. Agasthiyar is said to have lived in the southern Western Ghats approximately 2000 years ago. Most of the Kani tribals have a general knowledge of medicinal plants that are used for first aid remedies, to treat cough, cold, fever, headache, poisonous bites and some other simple ailments.

2.2. Data collection

The study area was investigated to get information from tribal practitioners and also to cross check the information provided by the other tribal practitioners during the earlier visits. During each field survey at least 10 days were spent with the local people in their tribal hamlets. In order to document the utilization of medicinal plants, a total of eight field surveys were carried out from August 2003 to October 2007 in Tirunelveli hills. A total of six resource persons or informants or traditional healers were identified to get the ethnomedicinal information through direct interviews/oral conversations. They have sound knowledge on medicinal plants found in their surrounding areas and they practice medicine within their



Fig. 1. Location map of Tirunelveli hills in Tamil Nadu, southern India.

families and neighbors. A field datasheet has been prepared to record the plant details with ethnomedicinal information gathered from the traditional healers (Fig. 2). Information on local name of plant, plant part used for curing, method of preparation, any other plants/agents used as ingredients, modes of administration and etc. were recorded for each collected ethnomedicinal plant.

Identity of the collected plant species were done with the volumes of *The Flora of Presidency of Madras* (Gamble, 1935) and *The Flora of Tamil Nadu Carnatic* (Matthew, 1983). Angiosperm Phylogeny Group III (APG III, 2009) was followed to classify the species and binomial was checked with the International Plant Names Index (IPNI). Herbarium specimens were collected in triplicates; one set of voucher specimens were deposited in the herbarium of Entomology Research Institute (ERIH), Loyola College, Chennai, Tamil Nadu and the duplicate voucher specimens were deposited in Regional Medical Research Centre (RMRC–ICMR), Belgaum (Karnataka) and Indian Council of Medical Research (ICMR), New Delhi, India for future reference.

2.3. Ailment categories

Based on the information obtained from the traditional healers in the study area, all the reported ailments were categorized into 15 categories (Table 1) viz. gastro-intestinal ailments (GIA), dermatological infections/diseases (DID), respiratory systems diseases (RSD), genito-urinary ailments (GUA), fever (Fvr), skeleto-muscular system disorders (SMSD), poisonous bites (PB), circulatory system/cardiovascular diseases (CSCD), endocrinal disorders (ED), liver problems (LP), dental care (DC), hair care (HC), ear, nose, throat problems (ENT), cooling agents (CA) and general health (GH). Sev-



Fig. 2. Format of field datasheet used to record the plant details with ethnomedicinal information.

eral diseases were placed in one ailment category based on the body systems treated.

2.4. Data analysis

2.4.1. Informant consensus factor (F_{ic})

The informant consensus factor (F_{ic}) was used to see if there was agreement in the use of plants in the ailment categories between the plant users in the study area. The F_{ic} was calculated using the following formula (Heinrich et al., 1998):

$$F_{\rm ic} = \frac{N_{\rm ur} - N_{\rm t}}{N_{\rm ur} - 1}$$

Where N_{ur} refers to the number of use-reports for a particular ailment category and N_t refers to the number of taxa used for a particular ailment category by all informants. The product of this factor ranges from 0 to 1. A high value (close to 1.0) indicates that relatively few taxa are used by a large proportion of the informants. A low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness.

2.4.2. Use value (UV)

The relative importance of each plant species known locally to be used as herbal remedy is reported as use value (UV) and it was calculated using the following formula (Phillips et al., 1994):

$$UV = \frac{\Sigma U}{n}$$

Where UV is the use value of a species, U is the number of usereports cited by each informant for a given plant species and n is the total number of informants interviewed for a given plant. The UV is helpful in determining the plants with the highest use (most frequently indicated) in the treatment of an ailment. UVs are high

Table 1

Ailments grouped by different ailment categories.

• • •		
Ailment categories	Biomedical terms	Tamil terms
Circulatory sys-	Blood purification	Rattha sutthigarippu
tem/cardiovascular	Heart strength	Idhaya valimai
diseases (CSCD)	Memory power	Gnabaga sakthi
Cooling agents (CA)	Body cooling	Udal kulircchi
Dental care (DC)	Foul odour	Vai thurnatram
	Teeth strength	Pal valimai
	Toothache	Pal vali
	Worms in gums and teeth	Pal sotthai
Dermatological	Burns	Theekkavam
infections/diseases	Cuts	Vettukkayam
	Falon	Nagacchutthi
(DID)	Fungal infaction on head	Puluvottu/poocchikadi
	Itching	Arippu/pamaicchal
	Dimplos	Mugapparu
	Scabios	Sori/sirangu
	Stables	The price al
	SKIII IIIIIdululi	Veinnun
	would in lips and tongue	Valppuli
T (1)	wounds	Kaayam
Ear, nose, throat	Colour blindness	Nirakkurudu
problems (ENI)	Earache	Kaadhu vali
	Eye cooling	Kan kulircchi
	Eye pain	Kan vali
	Nasal infections	Suvasha thottru
	Throat pain	Thondai vali
Endocrinal disorders	Diabetes	Sarkkarai/neerilivu noi
(ED)		
Fever (Fvr)	Fever	Kaicchal
Gastro-intestinal	Constipation	Malacchikkal
ailments (GIA)	Dysentery	Seedhabaethi
	Gastric complaints	Vayvu kolaru
	Indigestion	Ajeeranam
	Intestinal ulcer	Kudal pun
	Stomachache	Vavitru vali
General health (GH)	Body refreshment	Udal puthunarcchi
	Body shining	Udal palapalappu
	Body strength	Udal valimai
	Disease resistant	Noi ethirppu sakthi
	Weight loss	Udal paruman kuraitthal
Cenito-urinary	Abortion	Karu kalainnu
ailments (GUA)	Breast nain	Marbaga vali
unificitits (GOIT)	Delivery pain	Pirasaya yali
	Lactation	Paal suratthal
	Malo fortility	Appendicate and a substantial
	Over blooding	Patthapokku
	Sovuel power	Virainpu calthi (Mala)
	Sexual power	Vilaippu saktiii (Male)
	Venereal diseases	Dynanu u pattin Daalyinai noi
	Den druff	Padivillal II01
Hall Cale (HC)	Creating of hoir	Podugu Nanai ilananai
	Graying of hair	Naral, Italiarai
	Hair growth	Mudi valardhal
	Hair loss	Mudi uthirdhal
Liver problems (LP)	Jaundice	Manjal kaamalai
Poisonous bites (PB)	Poison bites	Vishakkadi
	Scorpion sting	Thaelkkadi
	Snake bite	Pambukkadi
Respiratory systems	Asthma	Moocchu thinaral
diseases (RSD)	Bronchitis	Chali and irumal
	Chest pain	Nenju vali
	Cold	Jalathosham
	Cough	Irumal
Skeleto-muscular	Body pain	Udal vali
system disorders	Headache	Thalai vali
(SMSD)	Joint pain	Moottu vali
	Muscle pain	Thasai pidippu
	Rheumatism	Moottu vadham
	Swellings	Veekkam

when there are many use-reports for a plant and low when there are few reports related to its use.

2.4.3. Fidelity level (FL)

To determine the most frequently used plant species for treating a particular ailment category by the informants of the study area, we calculated the fidelity level (FL). The FL was calculated using the following formula (Friedmen et al., 1986):

$$FL(\%) = \frac{N_p}{N} \times 100$$

Where N_p is the number of use-reports cited for a given species for a particular ailment category and N is the total number of usereports cited for any given species. Generally, high FLs are obtained for plants for which almost all use-reports refer to the same way of using it, whereas low FLs are obtained for plants that are used for many different purposes (Srithi et al., 2009).

2.4.4. Relative importance (RI)

We calculated the relative importance (RI) of each medicinal plant based on the normalized number of pharmacological properties (PH) attributed to it and the normalized number of body systems (BS) it treated. Data on medicinal uses were organized according to the PH attributed to each taxon (e.g. analgesic, antiinflammatory etc.) and to the specific body systems treated (e.g. skin diseases, fever, asthma etc.). The RI was calculated using the following formula (Bennett and Prance, 2000):

$$\mathrm{RI} = \frac{\mathrm{Rel}\,\mathrm{PH} + \mathrm{Rel}\,\mathrm{BS}}{2} \times 100$$

Where RI is the relative importance, PH is the number of reported pharmacological properties for the given plant, Rel PH is the relative number of pharmacological properties (PH of a given plant/maximum PH of all reported species), BS is the number of body systems treated and Rel BS is the relative number of body systems treated (BS of a given plant/maximum BS of all reported species).

3. Results and discussion

3.1. Documentation of indigenous ethnomedicinal knowledge

The present study revealed the use of 90 species of plants distributed in 83 genera belonging to 52 families which were commonly used by most of the Kani traditional healers for the treatment of 65 types of ailments. The prominent family was Fabaceae with nine species, followed by Solanaceae and Euphorbiaceae with six and four species respectively. For each reported species we provided the botanical name of the plant, family, voucher specimen number, local (Tamil) name, life form, use value, parts used, ailments treated, method of preparation, mode of administration and relative importance (Table 2).

The medicinal uses of plants gathered in our study were compared with the previously published information from other parts of India. We found that there were 25 claims from the plants such as Abutilon indicum, Aerva lanata, Allium cepa, Ananus comosus, Atalantia monophylla, Bambusa arundinacea, Calophyllum inophyllum, Cleome viscosa, Datura metel, Evolvulus nummularius, Ficus religiosa, Leucas aspera, Mangifera indica, Melia azedarach, Michelia champaca, Mimusops elengi, Morinda pubescens, Opuntia dillenii, Pandanus fascicularis, Physalis minima, Sanseviera roxburghiana and Tephrosia purpurea were reported for the first time from the study area (new claims were given with asterisk mark in Table 2). However, no plants were reported as a new medicinal plant as all the plants were reported with different uses.

3.2. Life form and parts used

Herbs were the primary source of medicine (41%) followed by trees (31%), shrubs (18%) and climbers (10%) (Fig. 3). The frequent use of herbs among the indigenous communities is a result of wealth of herbaceous plants in their environs (Tabuti et al., 2003;



Fig. 3. Life forms of reported common medicinal plants.

Ayyanar and Ignacimuthu, 2005; Uniyal et al., 2006; Ragupathy et al., 2008; Giday et al., 2010) and Tirunelveli hills harbours more number of herbs as compared to trees, shrubs and climbers (Manickam et al., 2004). Among the different plant parts used, the leaves (50%) were most frequently used for the preparation of medicine solely or mixed with other plant parts. It was followed by fruit (17%), whole plant (6%), stem bark and flower (5%), stem (4%), seed (3%, including seed oil), rhizome (3%), bulb (2%), latex, root, root bark, resin and young twig (1% each) (Fig. 4). Many indigenous communities elsewhere also utilized mostly leaves for the preparation of herbal medicines (Mahishi et al., 2005; Ignacimuthu et al., 2006, 2008; Teklehaymanot et al., 2007; Srithi et al., 2009; Giday et al., 2010; Cakilcioglu and Turkoglu, 2010; Gonzalez et al., 2010). The reason why leaves were used mostly is that they are collected very easily than underground parts, flowers and fruits etc. (Giday et al., 2009) and in scientific point of view leaves are active in photosynthesis and production of metabolites (Ghorbani, 2005).



Fig. 4. Percentage of plant parts used for the preparation of medicine.

 Table 2

 List of commonly used medicinal plants by Kani tribals in Tirunelveli hills, India.

Botanical name (Family), voucher specimen number	Local name	Life form	Use value	Parts used	Ailment category: no. of use-reports (ailments treated)	Preparation	Application	RI
Abutilon indicum G. Don. (Malvaceae) ERIH-03	Thutthi	Sh	0.67	Lf, Sb	GUA: 2 (venereal diseases [*] , over bleeding [*])	Paste	Oral	47.5
		_			CA: 2 (body cooling) [*]	Paste	Oral	
Acacia nilotica (L.) Del. (Fabaceae) ERIH-19	Karuvelam	Tr	0.83	Sb	DC: 3 (foul odour,	Decoction	Mouth wash	45.0
Acalumba indica I (Euphorbiacoao) EPIH 445	Kuppaimoni	Цо	0.02	If	DID: 5 (itching wounds)	Pacto	Oral	225
Achyranthes aspera I (Amaranthaceae) FRIH-65	Naavuruvi	He	0.33	If	DC: 2 (toothache)	Paste	Tooth powder	32.5
Adhatoda vasica Medicus (Acanthaceae) FRIH-37	Adathodai	Sh	1.67	If	RSD: 5 (asthma_cold)	Paste	Oral	47.5
nanaroda vasica medicas (nearithaceae) Ekiri 57	Mathodal	511	1.07	LI	SMSD: 2 (headache)	Paste	Oral	17.5
					ENT: 3 (earache)	Paste	Oral	
Aerva lanata Juss. (Amaranthaceae) ERIH-412	Kannu peelai	He	0.67	Wp	RSD: 3 (asthma [*] , chest	Powder	Oral	47.5
	1				pain [*])			
					PB: 1 (poison bites)	Juice	Oral	
Allium cepa L (Alliaceae) ERIH-48	Chinna vengayam	He	1.33	Bb	SMSD: 3 (rheumatism [*] , headache)	Juice	Topical	60.0
					DID: 5 (baldness due to	Juice	Topical	
					fungal infection)			
Aloe vera (L.) Burm. f. (Asphodelaceae) ERIH-49	Sotthu katthalai	He	0.83	Lf	GIA: 5 (stomachache)	Paste	Oral	22.5
Alpinia galanga Sw. (Zingiberaceae) ERIH-84	Chittharattai	He	1.67	Rh	RSD: 4 (asthma, cold, cough)	Powder	Oral/Topical	62.5
					SMSD: 2 (headache)	Paste	Oral/Topical	
					Fvr: 4 (fever)	Paste	Oral/Topical	
Alternanthera sessilis (L.) R.Br. ex. DC. (Amaranthaceae) ERIH-50	Ponnankanni keerai	He	0.83	Lf	ENT: 5 (eye pain)	Juice	Topical	17.5
Anacardium occidentale L. (Anacardiaceae) ERIH-53	Munthiri	Tr	0.67	Fr	RSD: 2 (asthma [*])	Juice	Oral	47.5
					SMSD: 1 (headache)	Juice	Oral	
					DID: 1 (wounds [°])	Juice	Oral	
Ananus comosus (L.) Merr. (Bromeliaceae) ERIH-56	Annachi	He	0.17	Fr	GUA: 1 (venereal diseases)	Juice	Oral	20.0
Areca catechu L. (Arecaceae) ERIH-62	Kottai pakku	Tr	0.83	Fr	DID: (burns)	Powder	Topical	27.5
Atalantia manankulla (L.) Cara (Butagaga) FBUL 70	Vattu alumitahai	т.	0.92	1.6	GH: 2 (body refreshment)	Raw	Oral	20.0
Alululliu monophyllu (L.) Coll. (Kulaceae) EKIH-79	Kattu elullittellai	11	0.85	LI Fr	RSD. 3 (cold) PB: 2 (poison bites [*])	Decoction	Oral	50.0
Azadirachta indica A Juss (Meliaceae) FRIH-67	Vembu	Tr	1.67	Sh	PB: 3 (poison bites)	Paste	Oral	62.5
Azuunuentu muleu A. Juss. (Menaceae) Ekin-67	venibu	11	1.07	If	GIA: 5 (stomachache)	Paste	Oral	02.5
				LI	DID: 2 (scabies)	Paste	Topical	
Bambusa arundinacea (Retz.) Willd. (Poaceae) ERIH-394	Moongil	Sh	0.83	Sd	SMSD: 5 (rheumatism [*])	Paste	Oral	50.0
Begonia malabarica Lam. (Begoniaceae) ERIH-75	Theenda Maniyan	Sh	0.33	Lf	RSD: 2 (nasal infections)	Paste	Topical	20.0
Calophyllum inophyllum L. (Clusiaceae) ERIH-72	Pinnai maram	Tr	1.33	Sd, Lf	DID: 3 (baldness due to	Paste	Topical	75.0
				Sd	fungal infection [*] , skin irritation)		·	
					ENT: 1 (earache [*])	Paste	Oral	
					SMSD: 2 (headache)	Paste	Oral	
					HC: 1 (hair growth [*] , greving of hair)	Paste	Oral	
Capsicum frutescens L. (Solanaceae) ERIH-373	Kaanthari milagai	He	1.00	Fr	GUA: 6 (delivery pain)	Paste	Oral	35.0
Cardiospermum halicacabum L. (Sapindaceae)	Mudakkathan	Cl	1.00	Lf	GUA: 1 (delivery pain)	Juice	Oral	42.5
ERIH-361					SMSD: 5 (body pain,	Decoction	Topical (bath)	
					rheumatism)	paste	Oral	
Carica papaya L. (Caricaceae) ERIH-614	Pappali	Tr	0.83	Fr	GIA: 3 (constipation)	Raw	Oral	45.0
				Lx	DC: 2 (toothache)	Paste	Toothpaste	
Carissa carandas L. (Apocynaceae) ERIH-83	Kalakkai	Sh	1.33	Fr	GIA: 4 (stomachache)	As pickle	Oral	30.0
					CA: 4 (body cooling)	As pickle	Oral	
Cassia alata L. (Fabaceae) ERIH-89	Seemai agathi	Sh	0.33	Fl	GUA: 2 (abortion)	Juice	Oral	20.0

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Table 2 (Continued)

Botanical name (Family), voucher specimen number	Local name	Life form	Use value	Parts used	Ailment category: no. of use-reports (ailments treated)	Preparation	Application	RI
Cassia auriculata L. (Fabaceae) ERIH-86	Avaram poo	Sh	1.17	Fl Lf	GIA: 2 (stomachache) DID: 5 (skin irritation,	Paste Paste	Oral Topical	32.5
<i>Centella asiatica</i> (L.) Urban. (Mackinlayaceae) ERIH-97	Vallarai	Не	1.67	Lf	itching) CSCD: 6 (memory power for children)	Powder	Oral	47.5
					HC: 2 (hair growth)	Powder	Oral	
Ciercus quadrangularia L (Vitacoao) EPUL 00	Dirandai	ch	1.00	C+ I F	CIA: 6 (stomachasha)	Paste Douidor pasto	Oral	175
Citrus aurantifolia (Christm. & Panz.) Sw. (Rutaceae) ERIH-109	Elumitcahi	Tr	0.67	Lf	GIA: 4 (indigestion)	Juice	Oral	32.5
Cleome viscosa L. (Cleomaceae) ERIH-78	Nai velai	Не	1.67	Lf	DID: 3 (wounds) SMSD: 5 (swellings, headache [*]) Fyr: 2 (feyer [*])	Paste Paste, juice	Topical Topical Topical	57.5
Clitoria ternatea L. (Fabaceae) ERIH-206	Sangu pushpam	Cl	0.83	Lf	ENT: 3 (throat pain) SMSD: 2 (swellings)	Paste	Oral Tropical	32.5
Coccinia indica (L.) Voigt. (Cucurbitaceae) ERIH-226	Kovai pazham	Cl	1.50	Lf	GH: 5 (body strength) GUA: 4 (to increase semen production)	Paste Paste	Oral Oral	42.5
Commeling henghalensis L. (Commelinaceae) ERIH-60	Thengai chedi	He	0.50	St	DID: 3 (wounds)	luice	Topical	22.5
Costus speciosus Smith. (Costaceae) ERIH-103	Kottak-kilangu	Не	1.17	Rh	ED: 5 (diabetes)	Paste Juice	Oral	40.0
				Lf	DID: 2 (wounds)	Juice	Topical	
Cynodon dactylon (L.) Pers. (Poaceae) ERIH-118	Arugampul	Не	0.83	Wp	DID: 2 (itching) SMSD: 2 (body pain)	Decoction Decoction	Oral Oral	45.0
					RSD: 1 (asthma)	Decoction	Oral	
Datura metel L. (Solanaceae) ERIH-123	Umatthai	He	0.67	Lf	ENT: 4 (earache [*])	Juice	Topical	17.5
Elettaria cardamomum (L.) Maton. (Zingiberaceae) ERIH-129	Elam	Не	0.67	Fr	SMSD: 2 (headache, rheumatism)	Powderr	Oral	55.0
					RSD: 2 (asthma)	Powder	Oral	
Euphorbia hirta L. (Euphorbiaceae) ERIH-104	Amman paccharisi	He	0.83	Lx, Lf	DID: 5 (wounds)	Raw, paste	Topical	35.0
Evolvulus nummularius L. (Convolvulaceae) ERIH-217	Vellai vishnukranti	He	0.50	Lf, Fl, Rt	GIA: 3 (dysentery)	Paste	Oral	15.0
Ficus benghalensis L. (Moraceae) ERIH-130	Ala maram	Tr	1.67	Lf	DID: 4 (wounds)	Powder	Topical	47.5
		_		Yt	DC: 6 (to strengthen the teeth)	Raw	Toothbrush	
Ficus religiosa L. (Moraceae) ERIH-134	Arasa maram	Tr	1.33	Lt, Sb	GIA: 4 (stomachache, Indigestion) RSD: 4 (breast pain [*])	Powder	Oral	47.5
				Sb		Powder	Oral	
Gymnema sylvestre (L.) R. Br. (Apocynaceae)	Sirukurinchan	Cl	2.00	Lf	ED: 6 (diabetes) PB: 3 (scorpion sting	Powder	Oral Oral	65.0
LMI-405					snakebite)	Powder	Oral	
Hibiscus rosa-sinensis L. (Malvaceae) ERIH-141	Chembarutthi	Sh	1.17	Fl	CSCD: 2 (to strengthen the	Raw	Oral	47.5
				Lf	GUA: 2 (venereal diseases) GIA: 2 (stomachache)	Powder Powder	Oral Oral	
Hygrophila auriculata (Schum.) Heine. (Acanthaceae) ERIH-655	Neermulli chedi	Sh	0.50	Lf	RSD: 3 (cough)	Juice	Oral	25.0
Jatropha gossypifolia L. (Euphorbiaceae) ERIH-416	Athalai	Не	1.00	Rs	DC: 4 (foul odour, toothache)	Powder	Toothpowder	45.0
					DID: 2 (wounds in lips and tongue)		Topical	
Kalanchoe pinnata (Lam.) Pers. (Crassulaceae) ERIH-68	Kutti podum chedi	He	0.50	Lf	CA: 3 (body cooling)	Decoction	Oral	17.5
Lawsonia inermis L. (Lythraceae) ERIH-155	Maruthani	Sh	1.67	Lf	DID: 5 (heel cracks, felon)	Paste	Topical	60.0

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					SMSD: 4 (rheumatism)	Paste	Topical	
					GH: 1 (disease resistance in children)	Paste	Topical (bath)	
Leucas aspera (Willd.) Link (Lamiaceae) ERIH-66	Thumbai	He	1.00	Lf	GIA: 2 (dysentery)	Juice	Oral	70.0
				Fl	Fvr: 2 (fever)	Juice	Oral	
					SMSD: 1 (headache)	Paste	Topical	
					ENT: 1 (eye pain [*] , colour blindness [*])	Paste	Oral/Topical	
Mangifera indica L. (Anacardiaceae) ERIH-59	Maa maram	Tr	0.50	Sb	SMSD: 2 (body pain [*])	Powder	Oral	55.0
					GUA: 1 (delivery pain*)	Paste	Oral	
Melia azedarach L. (Meliaceae) ERIH-57	Malai vemThottl	Tr	1.83	Lf	GIA: 4 (stomachache)	Juice	Oral	75.0
	surungibu			St, Rb	DID: 4 (skin irritation)	Juice	Tropical	
				Lf	SMSD: 2 (body pain [*])	Paste	Tropical	
					GUA: 1 (to increase sperm production)	Paste	Oral	
Michelia champaca I (Magnoliaceae) FRIH-391	Shenhagam	Tr	033	If	FNT: 2 (eve pain*)	Decoction	Tonical	40.0
Milletia ninnata (L.) Panigrahi (Fabaceae) FRIH-25	Punga maram	Tr	0.55	Sd	DID: 4 (wounds)	Raw	Topical	35.0
Mimosa nudica L. (Fabaceae) FRIH-238	Thottal surungi	He	0.50	Lf	DID: 3 (nimples)	Paste	Topical	35.0
Mimusons elengi L. (Sapotaceae) FRIH-162	Magila maram	Tr	0.33	FI	GH: 2 (to get shining	luice	Oral	22.5
minusops elengi E. (Supotaceae) Elen 102	magna marann		0.55		body [*])	Juice		22.5
Mollugo nudicaulis Lam. (Molluginaceae) ERIH-413	Parpadagam	He	1.33	Wp	Fvr: 2 (fever)	Decoction	Oral	67.5
				Lf	RSD: 2 (cough)	Decoction	Oral	
					SMSD: 2 (headache)	Decoction	Oral	
					GIA: I (stomachache)	Powder	Oral	
Momenting diving Devel (Cugurpitagene) EDILL 46	Kaattu pagarkai	CI	1.00	If	GUA: I (velleleal diseases)	Powdel	Oral	22 5
Morinda nubeccene Devb. (Pubiccece) ERIII-40	Manianatthi	CI Tr	1.00	LI	SMSD: 1 (rhoumaticm [*])	Decoction	Topical	52.5
Morniau pubescens Roxb. (Rublaceae) ERIH-100	Manjanattii	11	0.07	LI	SWSD. I (Incullatishi)	Juice	Topical	55.0
					GIA: 2 (indigestion)	Decoction	Oral	
					DID: 1 (wounds)	Paste	Topical	
Moringa oleifera Lam. (Moringaceae) ERIH-171	Murangai	Tr	1.00	Fl	GUA: 6 (to increase sperm production)	Powder	Oral	60.0
Mukia maderaspatana (L.) M. Roem. (Cucurbitaceae) ERIH-427	Musu-musukkai	Cl	0.50	Lf	GH: 3 (body strength)	Paste	Oral	22.5
Murraya koenigii (L.) Spreng. (Rutaceae) ERIH-172	Karuveppilai	Tr	1.83	Lf	ENT: 5 (eye pain, eye	Paste	Oral	37.5
					HC: 6 (dandruff hair loss)	Daste	Topical	
Ocimum tenuiflorum I (Lamiaceae) FRIH-114	Nalla thulasi	He	1.67	If	RSD: 5 (cold_cough)	luice	Oral	67.5
oeinian tenagioran E. (Eannaceae) Ekiri-114	Ivana thulasi	ne	1.07	LI	Fyr: 5 (fever)	Juice	Oral	07.5
Opuntia dillenii Haw (Cactaceae) FRIH-183	Sappathi kalli	Sh	0.50	St	DID: 3 (wounds [*])	Paste	Topical	15.0
Pandanus fascicularis Lam. (Pandanaceae) ERIH-672	Thaalai	Sh	0.33	Yt. Lf	LP: 2 (jaundice *)	Raw	Oral	32.5
Phoenix sylvestris (L.) Roxb. (Arecaceae) ERIH-38	Pereechai	Tr	1.33	Fr	GUA: 4 (male fertility)	Raw	Oral	32.5
					GH: 4 (body strength)	Raw	Oral	
Phyllanthus amarus Schum & Thonn. (Phyllanthaceae) ERIH-82	Keelanelli	He	1.00	Lf	LP: 6 (jaundice)	Juice	Oral	37.5
Phyllanthus emblica L. (Phyllanthaceae) ERIH-184	Periya nelli	Tr	1.00	Fr	GH: 6 (body strength)	Powder	Oral	37.5
Physalis minima L. (Solanaceae) ERIH-13	Sodakku thakkali	He	0.67	Lf	GUA: 4 (venereal diseases [*] , to increase lactation)	Decoction	Oral	30.0
Piper betle L. (Piperaceae) ERIH-215	Vetrilai	Cl	0.67	Lf	DID: 4 (itching, skin irritation)	Paste	Topical	27.5
Piper nigrum L. (Piperaceae) ERIH-230	Milagu	Cl	1.17	Fr	RSD: 5 (cough, bronchitis)	Powder	Oral	55.0
					PB: 2 (snakebite)	Powder	Oral	
Punica granatum L. (Lythraceae) ERIH-185	Madhulai	Sh	0.33	Fr	GIA: 2 (stomachache)	Powder	Oral	42.5
Ricinus communis L. (Euphorbiaceae) ERIH-438	Amanakku	Sh	0.67	Sd	SMSD: 4 (joint pain, muscle	Raw	Topical	32.5
Sansevieria roxburghiana Schult. f. (Asparagaceae) ERIH-186	Marul	He	0.33	St	ENT: 2 (earache [*])	Juice	Topical	22.5
Santalum album L. (Santalaceae) ERIH-353	Santhanam	Tr	1.33	St	DID: 4 (pimples)	Paste	Topical	47.5
Seconum indicum I (Pedaliaceae) FRIH_210	Fllu	На	0 33	Sd	DID: 2 (skin irritation	Paste	Topical	35.0
Scouman malcum E. (1 Cuanaccac) ENIT-210	Lilu	110	0.00	Ju	itching)	I aste	ισριταί	0.00

Table 2 (Continued)

Botanical name (Family), voucher specimen number	Local name	Life form	Use value	Parts used	Ailment category: no. of use-reports (ailments treated)	Preparation	Application	RI
Sesbania grandiflora Pers. (Fabaceae) ERIH-222	Agathi	Tr	0.33	Lf	CA: 2 (body cooling)	Decoction	Oral	27.5
Solanum nigrum L. (Solanaceae) ERIH-198	Manathakkali	He	0.50	Lf	GIA: 3 (intestinal ulcer)	Decoction	Oral	40.0
Solanum surattense Burm, f. (Solanaceae) ERIH-216	Kandan-katthiri	He	1.00	Fr	DC: 6 (toothache, to kill	Raw	Inhalation	30.0
					worms in gums and teeth)		(mouth)	
Solanum trilobatum L. (Solanaceae) ERIH-606	Thudhuvalai	Cl	0.83	Fl	GUA: 3 (male fertility)	Raw	Oral	25.0
				Lf	GIA: 2 (constipation)	Paste	Oral	
Sphaeranthus indicus L. (Asteraceae) ERIH-370	Kottaikaranthai	He	0.33	Wp	DID: 2 (skin irritation)	Paste	Topical	35.0
Strychnos nux-vomica L. (Loganiaceae) ERIH-420	Etti/Kanchiram	Tr	0.33	Lf	SMSD: 2 (rheumatism)	Paste	Topical	32.5
Syzygium cumini Skeels. (Myrtaceae) ERIH-388	Naval	Tr	1.83	Lf,	ED: 6 (diabetes)	Juice, raw	Oral	57.5
				Fr	GIA: 5 (indigestion,	Paste	Oral	
					stomachache)			
Tamarindus indica L. (Fabaceae) ERIH-610	Puliya maram	Tr	0.50	Fl	CA: 2 (body cooling)	Decoction	Oral	40.0
	-			Lf	ENT: 1 (eye cooling)	Paste	Topical	
Tectona grandis L.f. (Verbenaceae) ERIH-414	Thekku maram	Tr	0.33	Sd	HC: 2 (hair loss, dandruff)	Paste	Topical	35.0
Tephrosia purpurea (L.) Pers. (Fabaceae) ERIH-236	Kolunchi	He	0.33	Lf	GIA: 2 (gastric problems [*])	Paste	Oral	25.0
Terminalia chebula Retz. (Combretaceae) ERIH-607	Kadukkai	Tr	1.83	Fr	GIA: 3 (intestinal ulcer)	Powder	Oral	67.5
					GUA: 5 (to stimulate sexual	Raw	Oral	
					power to men)			
					DC: 3 (toothache)	Raw	Toothpowder	
Trianthema portulacastrum L. (Aizoaceae) ERIH-602	Saaranatthi	He	0.33	Lf, Rt	GH: 2 (disease resistance)	Paste	Topical	27.5
Tribulus terrestris L. (Zygophyllaceae) ERIH-410	Nerunchil	He	1.00	Wp	Fvr: 2 (fever)	Paste	Topical	67.5
				Fr	SMSD: 2 (headache)	Paste	Topical	
					DID: 1 (heel cracks)	Paste	Topical	
					GH: 1 (body shining)	Powder	Topical	
Trichopus zeylanicus Gaertn. subsp. travancoricus (Bedd.)	Arokya pacchilai	He	1.50	Fr	RSD: 2 (asthma)	Raw	Oral	37.5
Burkill. (Trichopodaceae) ERIH-81	•			Lf	GH: 6 (body strength)	Raw	Oral	
					GUA: 1 (venereal diseases)	Paste	Oral	
Tridax procumbens L. (Asteraceae) ERIH-10	Vettu kaya poondu	He	0.50	Lf	SMSD: 3 (swellings)	Paste	Topical	25.0
Vitex negundo L. (Verbenaceae) ERIH-372	Notchi	Tr	0.83	Lf	SMSD: 1 (body pain)	Decoction	Topical (bath)	47.5
					PB: 4 (poison bites)	Paste	Oral	
Wedelia calendulacea Less. (Asteraceae) ERIH-383	Manjal karisalankanni	He	1.00	Lf	HC: 6 (hair loss, graying of	Powder	Topical	25.0
					hair)			
Ziziphus zizyphus (L.) H.Karst. (Rhamnaceae)	Elandai	Sh	1.33	Fr	CSCD: 2 (to purify blood)	Raw	Oral	55.0
ERIH-212					GH: 4 (weight loss)	Raw	Oral	

Parts used: Lf - leaf, Sb - stem bark, Wp - whole plant, Bb - bulb, Rh - rhizome, Fr - fruit, Sd - seed and seed oil, Lx - latex, Fl - flower, St - stem, Rt - root, Rb - root bark, Rs - resin, Yt - young twig; Life form: He - herb, Sh - shrub, Cl - climber, Tr - tree; Rl - relative importance.

* New claims.



Fig. 5. Categories of Kani's mode of utilization for the preparation of medicine.

3.3. Method of preparation and mode of administration of plants

The preparation and utilization of plant parts were grouped into five categories (Fig. 5). Of these, most commonly used method of preparation was paste (42%) followed by powder (18%), juice (17%), raw (13%, taken as raw and plant part prepared as pickles) and decoction (10%). Preparation of paste for the treatment of ailments is a common practice among the other tribal communities in India (Ignacimuthu et al., 2006; Ragupathy et al., 2008; Perumal Samy et al., 2008; Poonam and Singh, 2009; Rajakumar and Shivanna, 2009; Tushar et al., 2010; Upadhyay et al., 2010) and other parts of the World (Giday et al., 2007, 2010; Roosita et al., 2008). The paste was prepared by grinding the fresh or dried plant parts with oil or water. The powder was prepared by the grinding of shade dried plant parts. The decoction was obtained by boiling the plant parts in water until the volume of the water reduced to minimum or required amount. The inhalation was done by the burning of plant parts and inhaled the smoke through nose or mouth.

Internal uses (64%) were predominating over external or topical uses (32%) and nasal application. For topical use, the most important methods used were direct application of paste or medicated oil (with oil) and mostly dealt with diseases like skin disorders, wounds, heel cracks, poison bites, rheumatism, body pain and headache. Most of the medicines were given orally which is in agreement with some other studies conducted elsewhere (Ssegawa and Kasenene, 2007; Perumal Samy et al., 2008; Lee et al., 2008; Poonam and Singh, 2009; Andrade-Cetto, 2009).

3.4. Ingredients added

The medicinal preparations were made out of a single plant part or in combination of several plant parts. In case of Kani's medicinal preparations, multiple modes (57 plants) of preparation were dominating over the single mode (33 plants) of preparations (Table 3). Kani traditional healers used more than two or three plant parts for the preparation of medicine in the treatment of single or multiple ailments; the similar findings were reported by several researchers (Teklehaymanot et al., 2007; Ignacimuthu et al., 2008; Tabuti et al., 2010; Upadhyay et al., 2010). The frequent use of multiple plant remedies among the traditional healers could be attributed to the belief of synergic reactions where one plant could have a potentiating effect than other (Giday et al., 2010). It is believed that the multiple prescriptions contain a range of pharmacologically active compounds and poly-herbal treatment has more healing power than single medicinal plant treatment, since each medicinal plant used in the mixture is a remedy (Teklehaymanot et al., 2007).

As reported by Poonam and Singh (2009), Kani traditional healers too frequently use some adjuvants such as honey, cow/goat's milk, sugar, ghee, salt, boiled rice and butter milk to improve the acceptability and medicinal property of certain remedies. The oils of castor, coconut, gingelly, mustard, neem and pongam were commonly used for the preparation of paste/medicated oil. They were using specific plant parts and specific dosages for the treatment of diseases and the dose given to the patient depended on age, physical status and health conditions. Before giving treatment the condition of the patient was observed deeply and then they gave the prepared medicines.

3.5. Plant use values

The most commonly used species was *Gymnema sylvestre* with 12 use-reports by 6 informants, giving the highest use value of 2.00. *G. sylvestre* is attributed to its use in the treatment of various diseases and it is well recognized by all the informants as an antidiabetic plant. Many Irulas tribal families in Thanjavur district of Tamil Nadu, India are growing *G. sylvestre* as a climbing vine in their home and it was a household custom to consume one leaf a day (Ragupathy and Newmaster, 2009).

Other important plants with high use value were *M. azedarach*, *Murraya koenigii*, *Syzygium cumini* and *Terminalia chebula* (11 usereports by 6 informants with a UV of 1.83), *Adhatoda vasica*, *Alpinia galanga*, *Azadirachta indica*, *Centella asiatica*, *C. viscosa*, *Ficus benghalensis*, *Lawsonia inermis* and *Ocimum tenuiflorum* (10 use-reports by 6 informants with a UV of 1.67), *Coccinia indica* and *Trichopus zeylanicus* (nine use-reports by six informants with a UV of 1.50). Most of these plants were frequently used by the Paliyar tribals in Theni district of Tamil Nadu (Ignacimuthu et al., 2008) and tribal practitioners of Eastern Rajasthan (Upadhyay et al., 2010), India for the treatment of various ailments.

The plant with very low use value was *Ananas comosus* which is reported by only one informant with a UV of 0.17, but the informant is regularly using this plant in the treatment of venereal diseases. Similar to our study, tender leaves of the plant is used to cure irregular menstruation and sterility in women by the Indian, Mangoloid and Indo Aerian tribal people of Northeast India (Purkayastha et al., 2005). While tribal people in Cuba (Cano and Volpato, 2004) and Ghana (Asase et al., 2010) were using the plant for the treatment of malaria and liver pain respectively.

In general, scarce availability of the plants in the study area leads them to low UV (Rokaya et al., 2010) as in the case of Tirunelveli hills. In the present study, plants reported with a low use value (two use-reports by six informants with a UV of 0.33) were Achyranthes aspera, Begonia malabarica, Cassia alata, M. champaca, M. elengi, P. fascicularis, Punica granatum, Sansevieria roxburghiana, Sesamum indicum, Sesbania grandiflora, Sphaeranthus indicus, Strychnos nuxvomica, Tectona grandis, T. purpurea and Trianthema portulacastrum. Among these P. granatum is reported to have a very low UV of 0.23 among the local people of Mujib area in Jordan for treating gastrointestinal ailments (Hudaib et al., 2008) similar to Kani tribals.

3.6. Informant consensus factor

Generally F_{ic} of local knowledge for disease treatment depended on the availability of the plant species in the study area (Rajakumar and Shivanna, 2009). In order to use the informant consensus factor (F_{ic}), we classified the illnesses into broad disease categories. The F_{ic} values in our study are ranged from 0.63 to 0.88. The use categories with more than 50 use-reports were dermatological

Table 3

Ingredients added for the preparation of herbal medicines by the Kani traditional healers.

Botanical name	Other plants added in medicinal preparation	Other ingredients added
A indicum	Acharague recomeçue, Cassia quriculata, Cunadan dactulan, M. koonigii	Noom oil
A. Indicum	Asparagus racemosus, cassia auriculata, Cynodon aactylon, M. koenign	Neem on
A. indica	Albizia lebbeck, A. indica, M. pudica	-
A. aspera	A. nilotica, Carmona retusa, Hibiscus tiliaceus, Wrightia tinctoria	-
A. vasica	Piper nigrum (headache, earache, cold), Solanum trilobatum (asthma)	Honey
A. lanata	Cynodon dactylon, Hemidesmus indicus, Solanum trilobatum, Cassia auriculata, S.	Honey/milk
	nux-vomica (asthma, chest pain)	
А. сера	Santalum album, Scilla indica	Gingelly oil
A. vera	_	Ghee, sugar
A. galanga	A. vasica, Piper nigrum, Zingiber officinale	-
A sessilis	A vera A occidentale Elephantonus scaber	Castor oil
A occidentale	A comosus Withania somnifera (asthma)	_
A comocus	Paccaura courtallansis	Sugar
Areas satashu	Ducculeu coultulensis	Sugai
Areca calecina	P. Delle (Tellestillent)	Sumandu for feffesiment (calcium
A	A service Excelution debutes I are a Original astiticate (seld)	mix); coconut on (burns)
А. топорпуша	A. vasica, Eucalypius globules, L. aspera, Ocimum basilicum (cold)	-
	P. amarus, Psidium guajava, Thespesia populnea, Vitex negundo (poison bites)	
A. indica	Ficus retusa, Hibiscus rosa-sinensis, Pedalium murex, Pergularia daemia, P.	Pungam oil (M. pinnata)
	granatum (poison bites, stomachache)	
	Amorphophallus campanulatus, Elephantopus scaber (scabies)	Mustard oil
B. arundinacea	A. indicum, A. vasica, B. malabarica, Clitoria ternatea, S. cumini, Withania	-
	somnifera	
B. malabarica	Cardiospermum halicacabum. Elephantopus scaber	_
C. inophyllum	A. vasica, E. hirta, Toddalia asiatica (fungal infection on head earache	-
	headache, hair care)	
Cansicum frutescens		Coconut honey
Cardiospormum balicacabum	M koonigii Dodalium muray S surattansa (rhoumatism)	Boiled rice (delivery pain)
Carica papaya	w. Koenigii, reuuliulli lilulex, 5. Sulullense (lilleullidlisiii)	Salt (toothacha)
	-	Salt (toothache)
Carissa carandas	-	Food
C. alata	Carica papaya, P. granatum, S. surattense	-
Cassia auriculata	-	Honey (stomachache)
	A. indicum, Acorus calamus, Alpinia calcarata, Hibiscus rosa-sinensis, Lippia	Coconut oil
	nodiflora, M. pinnata (skin diseases)	
C. asiatica	Cleome viscosa, Cynodon dactylon, E. hirta (headache, hair care)	Salt, milk
C. quadrangularis	-	Honey (stomachache)
C. aurantifolia	Coriandrum sativam	_
C viscosa	A indica Mirabilis jalana Pergularia daemia (fever headache)	Mustard oil
el histopa	na maloa, mnabilo falapa, rongalana adoma (rover, nedadene)	Castor oil (wounds swellings)
Clitoria ternatea	Aristida setacea (Cindica (swellings)	easter on (wounds, swennigs)
Cindica	Canna indica, D. amhlica, T. zaulanicus, Zizinhus zizunhus	Choo
C. Inuicu	Cunna maica, P. emblica, T. Zeylamcus, ZiZiphus ZiZyphus	Gliee
C. Dengnalensis	Areca catecha, Canna matca	-
Costus speciosus	Canna indica, Cynodon dactylon, Glycerrhiza glabra, P. granatum (wounds)	-
Cynodon dactylon	A. nilotica, A. vasica, S. cumini (asthma)	-
D. metel	-	Gingelly oil
Elettaria cardamomum	A. galanga, Piper nigrum, Zingiber officinale (headache, asthma)	Sugar
E. hirta	A. indica, Begonia fallox, Cissampelos pareira, C. benghalensis (wounds)	-
E. nummularius	Bidens pilosa, Datura innoxia, R. communis, Vitex altissima	-
F. religiosa	Ficus retusa, Acacia pennata, B. malabarica, Cocculus hirsutus (indigestion, breast	Honey
	pain)	-
G. svlvestre	-	Milk
Hibiscus rosa-sinensis	-	Honey
	A sessilis C asiatica Hemidesmus indicus Pavetta indica Vetiveria zizanioides	Milk
	(venereal diseases, stomachache)	
H auriculata	(venerear discuses, storiachaelle)	Honey
II. uu icuiuu Iatropha gossynifelia	A nilotica Carica nanava (foul odour, toothacho)	TOTCY
Juli opilu gossypijoliu Linormic	A. moneu, cuncu pupuyu (1001 00001, 100011d011C)	
L, IIICI IIIIS	D. manuburnea, costas speciosas, mibiscas rosa-sinensis (disease resistance in abildrap)	=
M in diam	Ciniciten)	Circus llux e il
M. indica	Asparagus racemosus, A. indica, S. nux-vomica (delivery pain)	Gingelly oil
M. azedarach	Arıstolochia indica, Mirabilis jalapa, Mucuna pruriens (to increase sperm	Ghee
	production)	
M. champaca	A. sessilis, Cocculus hirsutus, Cynodon dactylon, Tabernaemontana divaricata	-
M. pudica	C. indica, Evolvulus alsinoides, Hemidesmus indicus	-
M. elengi	A. sessilis, Hibiscus rosa-sinensis, Solanum melangena, Wedelia calandulacea	-
M. nudicaulis	A. vera, C. asiatica, Coldenia procumbens, Madhuca longifolia, P. emblica	Sugar
	(stomachache, venereal diseases)	-
M. dioica	A. galanga, Piper hymenophyllum, Piper nigrum	-
M. pubescens	A. vasica (rheumatism)	Gingelly oil
M oleifera	A cena Cuminum cominum	
M koenigii	A vera A sessilis Solanum trilohatum (hair cara)	_
0 tenuiflorum	Andrographis lingata Andrographis paniculata Cashania seehan	
	Anarographis inteata, Anarographis panicalata, sesbania sesban	-
	A. veru	-
Phoenix sylvestris	-	Honey
P. amarus	-	Milk
P. emblica	Terminalia bellirica, T. chebula	Ghee
P. betle	Piper nigrum	-
Dinor nigrum		
Piper nigrum	-	Honey

Table 3 (Continued)

Botanical name	Other plants added in medicinal preparation	Other ingredients added
S. grandiflora	-	Buttermilk
S. nigrum	A. cepa, Cuminum cyminum	-
Solanum trilobatum	A. cepa, C. asiatica (constipation)	-
S. cumini	-	Honey/milk (diabetes); goat's milk (indigestion)
T. grandis	A. vera, Cocculus hirsutus, Helicteres isora (hair care)	Coconut oil
T. purpurea	Carmona retusa, Piper hymenophyllum, Piper nigrum (gastric problems)	-
T. chebula	-	Ghee (ulcer); honey (to stimulate sexual power)
T. portulacastrum	Azima tetracantha, Cocculus hirsutus, Cuminum cyminum, Madhuca longifolia	-
T. terrestris	A. indica, F. religiosa, L. aspera, M. indica, Vitex negundo (fever, heel cracks)	-
T. zeylanicus subsp. travancoricus	<i>M. indica</i> (venereal diseases)	Honey (asthma, body strength)
T. procumbens	Cocculus hirsutus, Scilla indica	Castor oil
Vitex negundo	A. vasica (body pain); Thespesia populnea (poison bites)	-

infections/diseases (81 use-reports, 26 species), gastro-intestinal diseases (70 use-reports, 21 species) and skeleto-muscular system disorders (61 use-reports, 23 species) (Fig. 6). In the present study, endocrinal disorders and liver problems had the highest F_{ic} of 0.88 and 0.86 respectively and it is in agreement with the previous studies among the neighboring indigenous communities in Tamil Nadu, India; diabetes and jaundice had the highest F_{ic} of 1.00 among the Irulas in Thanjavur district (Ragupathy and Newmaster, 2009), jaundice has the highest F_{ic} of 0.92 among the Malasar tribals in Coimbatore district (Ragupathy et al., 2008) and 0.923 among the Paliyar tribals in Theni district (Pandikumar et al., 2011). *Phyllanthus amarus* and *G. sylvestre* were very commonly used for the treatment of jaundice and diabetes correspondingly in these studies.

The least agreement between the informants was observed in the skeleto-muscular system disorders with a F_{ic} of 0.63 followed by poisonous bites with a F_{ic} of 0.64, genito-urinary ailments and ear, nose, throat problems with a F_{ic} of 0.65 each (Table 4). In the study by Rokaya et al. (2010) the highest F_{ic} is 0.40 and the lowest F_{ic} is 0.00, on the contrary our survey exemplified the lowest F_{ic} is 0.63. Thus the study indicated the degree of knowledge shared by the users in the study area regarding the use of medicinal plants in the treatment of ailments is high.

We found that dermatological infections/diseases, skeletomuscular system disorders and gastro-intestinal ailments employed the most plants with 26, 23 and 21 species respectively which was in agreement with the study of Andrade-Cetto (2009). Skeleto-muscular system disorders had the lowest F_{ic} of 0.63, but this ailment category ranks third in the number of usereports (61) and number of taxa (23) attributed to this category. It may be due to the lack of communication among the informants in the study area who are practicing this ailment category (Rokaya et al., 2010) or it may due to the lack of skeleto-muscular system disorders among the studied tribal people (Ragupathy et al., 2008). Heinrich et al. (1998) reported that gastro-intestinal, dermatological and respiratory diseases have a high informant consensus among the Maya, Nahua and Zapotech people in Mexico. Our findings showed that these ailment categories had high number of use-reports among the Kani tribals with moderate F_{ic} values.

3.7. Fidelity level

We analyzed the categories with major agreements to highlight the most important plants in each category (Table 5). Of the reported plants, 29 species had highest fidelity level of 100%, most of which were used in single ailment category with multiple informants. For this analysis the plants with less than three usereports were not considered. The plants with highest FL of 100% were Acacia nilotica, Solanum surattense (DC), Acalypha indica, Commelina benghalensis, Euphorbia hirta, Mimosa pudica, O. dillenii, Piper



Fig. 6. Categories of ailments treated by Kani tribals arranged by number of use-reports.

Table 4

Informant consensus factor for commonly used medicinal plants.

Ailment category	Number of use-reports $(N_{\rm ur})$	Number of taxa (N_t)	Informant consensus factor (F_{ic})
Endocrinal disorders	17	3	0.88
Liver problems	8	2	0.86
Circulatory system/cardiovascular disorders	10	3	0.78
Dental care	26	7	0.76
Hair care	17	5	0.75
Gastro-intestinal ailments	70	21	0.71
General health	35	11	0.71
Dermatological infections/diseases	81	26	0.69
Respiratory system diseases	43	14	0.69
Fever	17	6	0.69
Cooling agent	16	6	0.67
Ear, nose, throat problems	27	10	0.65
Genito-urinary ailments	44	16	0.65
Poisonous bites	15	6	0.64
Skeleto-muscular system disorders	61	23	0.63
Total	487	159 [*]	

* A taxa may be reported in more than one ailment category.

betle, Milletia pinnata (DID), Aloe vera, Cissus quadrangularis, Citrus aurantifolia, E. nummularius, Momordica dioica, Solanum nigrum (GIA), Alternanthera sessilis, D. metel (ENT), B. arundinacea, Ricinus communis, Tridax procumbens (GUA), Hygrophila auriculata (RSD), Kalanchoe pinnata (CA), Mukia maderaspatana, Phyllanthus emblica (GH), P. amarus (ED) and Wedelia calendulacea (HC).

The maximum FL for the above plants indicated the 100% choice of the interviewed informants for treating specific ailments and

this could be an indication of their healing potential. In support to our study, 100% FL was reported in *P. amarus* for jaundice among the herbal healers in Shimoga district of Karnataka (Rajakumar and Shivanna, 2009) and Malasar tribals in Velliangiri hills of Tamil Nadu (Ragupathy et al., 2008), India. On the contrary, *R. communis* and *P. granatum* were documented to have 50% of FL for skin diseases and digestive disorders respectively by the local people of Palestine (Ali-Shtayeh et al., 2000).

Table 5

Fidelity level (FL) values for common medicinal plants used by Kani traditional healers by ailment category.

Ailment category	Most preferred species with specific ailment	FL (%)
Circulatory system/cardiovascular disorders	Ziziphus zizyphus (weight loss)	66.67
Cooling agent	K. pinnata	100.00
	Tamarindus indica	66.70
Dental care	A. nilotica (foul odour, toothache)	100.00
	S. surattense (toothache, to kill worms in gums and teeth)	100.00
	Jatropha gossypifolia (foul odour, toothache)	66.67
	F. benghalensis (to strengthen the teeth)	60.00
Dermatological infections/diseases	A. indica (itching, wounds)	100.00
	C. benghalensis, E. hirta, O. dillenii, M. pinnata (wounds)	100.00
	<i>M. pudica</i> (pimples)	100.00
	P. betle (itching, skin irritation)	100.00
	Cassia auriculata (skin irritation, itching)	71.50
Ear, nose, throat problems	A. sessilis (eye pain)	100.00
	D. metel (earache)	100.00
	Clitoria ternatea (throat pain)	60.00
Endocrinal disorders	Costus speciosus (diabetes)	71.40
Fever	A. galanga	40.00
	O. tenuiflorum	50.00
Gastro-intestinal ailments	A. vera, C. quadrangularis, M. dioica (stomachache)	100.00
	C. aurantifolia (Indigestion)	100.00
	E. nummularius (dysentery)	100.00
	S. nigrum (intestinal ulcer)	100.00
General health	M. maderaspatana, P. emblica (body strength)	100.00
	T. zeylanicus (body strength)	66.70
Genito-urinary ailments	Capsicum frutescens (delivery pain)	100.00
·	<i>M. oleifera</i> (to increase sperm production)	100.00
	P. minima (venereal diseases, lactation)	100.00
	Solanum trilobatum (male fertility)	60.00
Hair care	W. calendulacea (hair loss, greying of hair)	100.00
	<i>M. koenigii</i> (dandruff, hair loss)	54.50
Liver problems	P. amarus (jaundice)	100.00
Poisonous bites	Vitex negundo (poison bites)	80.00
Respiratory system diseases	H. auriculata (cough)	100.00
	Piper nigrum (cough, bronchitis)	71.40
Skeleto-muscular system disorders	B. arundinacea (rheumatism)	100.00
	R. communis (joint pain, muscle pain)	100.00
	T. procumbens (swellings)	100.00
	Cardiospermum halicacabum (body pain, rheumatism)	83.00
	M. indica (body pain)	66.70

3.8. Relative importance

The collected medicinal plants possessed number of pharmacological properties (Khare, 2007). The plant with more number of pharmacological properties (PH) was Moringa oleifera (20 PH); so, it had a normalized PH value of 1.00 (20/20). Mollugo nudicaulis was employed to treat five body systems and had a normalized BS value of 1.00 (5/5). C. inophyllum and M. azedarach had the highest RI of 75.0 and it was followed by Leucas aspera (70.0), M. nudicaulis, T. chebula, O. tenuiflorum, Tribulus terrestris (each with the RI of 67.5), G. sylvestre (65.0), A. galanga and A. indica (62.5), L. inermis and A. cepa (60.0), C. viscosa and S. cumini (57.5). These plants were also used to treat more body systems and were considered as most versatile taxa in the study area. According to Upadhyay et al. (2010) A. indica was recognized as most versatile taxa since it was mentioned by most of the informants among the tribal practitioners in Eastern Rajasthan, India. Many of the most versatile species reported in this study were similar for some neighboring indigenous communities in India (Muthu et al., 2006; Ignacimuthu et al., 2006, 2008; Poonam and Singh, 2009; Pandikumar et al., 2011).

3.9. Reliability of reported uses

According to Trotter and Logan (1986), plants which are used in repetitive fashion in any ailment could be more likely to have biologically active component or pharmacologically active. The Kani tribals used the fruit of *T. zeylanicus* for body strength and to treat asthma and venereal diseases with a use value of 1.5, RI of 37.5 and FL of 66.7%. It is claimed that one can live for days together without food and still be able to perform rigorous physical work by eating a few fruits of *Arokyapachilai* everyday and they named the plant as '*Arokyapachilai*' (greener of health). Due to its vital role in traditional medicine and nutritional efficiency it was recognized as 'Ginseng' of Kani tribals (Pushpangadan, 1988).

Most of the plants reported in this study has good evidence of effectiveness and were scientifically validated as significant pharmacological agents. For example, A. vasica is one of the most frequently used medicinal plants among various indigenous communities all over the World for respiratory problems, especially cold, cough and asthma and drugs with this plant has been used for a long period of time which does not has serious adverse effects (Claeson et al., 2000), and most of the studied Kani traditional healers using this plant for treating asthma and cold as well as headache and earache; G. sylvestre has been used in the treatment of diabetes for a long time in Indian traditional medicine and elsewhere in the World and it claimed to has blood glucose lowering activity both in vitro and in vivo by a number of reports (Mukherjee et al., 2006) and all the informants in the present study using this plant in the treatment of diabetes as well as poisonous bites and skin diseases. In support of our study, P. amarus has been scientifically proved to control hepatitis B and C viruses and possess hepatoprotective, immunomodulating and anti-inflammatory activity (Thyagarajan et al., 2002). A. indica, Anacardium occidentale, C. viscosa, E. hirta, O. dillenii and M. pinnata were used in the treatment of wound and related injuries by the Kani traditional healers and these plants showed significant wound healing and anti-inflammatory activity in experimental animals (Ayyanar and Ignacimuthu, 2009a).

The ethnomedicinal studies evidently pointed out that, instead of trying to identify the active components and pharmacological actions of plants through massive collection of plants from natural sources, it is better to start investigating the efficacy of the plant based on their use in folk medicine, since most of the commercially proven drugs used in modern medicine were initially tried in crude form in traditional or folk healing practices (Fabricant and Farnsworth, 2001).

4. Conclusion

The present study revealed that traditional medicines were still in common use by the Kani tribal communities and accurate knowledge of the plants and their medicinal properties were held by only a few individuals in this community. Hence a need for detailed investigation of ethnobotanical knowledge held by each tribal community is required before such valuable knowledge vanishes. Thus, our work would be useful in preventing the loss of ethnomedicinal traditions of Kani tribal communities. The new claims which are recorded from the study area showed that still much can be learned from investigating herbals available abundantly in the forests. The plants with highest fidelity level and use values in the present study may indicate the possible occurrence of valuable phytochemical compounds and it requires a search for potential new drugs to treat various ailments.

The efficacy and safety of all the reported ethnomedicinal plants needs to be evaluated for phytochemical and pharmacological studies especially the plants with high informant consensus factor, use value, fidelity level and relative importance should be given priority to carry out bioassay and toxicity studies. As a result of the study we are suggesting the plants *A. galanga, A. indica, C. inophyllum, G. sylvestre, L. aspera, M. azedarach, M. nudicaulis, O. tenuiflorum, S. cumini, T. chebula* and *T. terrestris* for further ethnopharmacological studies, since these plants had the high UV and RI values. Of the newly reported claims in the present study *B. arundinacea, D. metel, E. nummularius, O. dillenii* and *P. minima* had highest FL of 100% for specific ailments and these plants can also be further analyzed for the associated pharmacological studies.

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