



Ethnomedicinal plants to cure skin diseases—An account of the traditional knowledge in the coastal parts of Central Western Ghats, Karnataka, India



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ABSTRACT

Ethnopharmacological relevance: Documentation of ethnomedicinal knowledge pertaining to the treatment of different types of skin diseases from the Central Western Ghats of India, a rich habitat of different ethnic communities.

Materials and methods: Frequent field surveys were carried out to invent the 'key informants' in the treatment of skin diseases in the study area. The information was collected through semi-structured open ended interviews with questionnaire in their local Kannada language. All medicinal plants recorded for the treatment of skin diseases were photographed in the field; voucher specimens were made subsequently and are deposited in the Herbarium, P.G. Department of Botany, Karnatak University, Dharwad. The information such as botanical name, status, family, vernacular name, habit and habitat, analysis like percentage of parts used, percentage of drug preparations, use value (UV), informants consensus factor (ICF), fidelity level (FL) and correlation between UV and use mention (Np) of the plants are provided.

Results: In all, 48 informants were interviewed. Amongst which 38 were the 'key informants' who gave the information exclusively about the treatment of skin diseases. Among 102 plant species collected, seven species are endemic to India and eleven species have their nativity outside India. Twelve species could be considered as new claims for skin diseases as their use has not been mentioned in Ayurveda or any other research articles surveyed. Of all the drug formulations, paste is the most preferred method (50%) followed by oil extraction (18.89%), juice (14.44%), ash (4.44%) etc. The highest UV is for *Pongamia pinnata*, *Naregamia alata*, *Randia dumetorum* and *Girardinia diversifolia* (1.50 each). The treatment for different types of skin diseases by the herbal healers are classified into 13 categories, out of which ringworm scored the highest ICF value. Similarly, the 100% FL value scored was in the order of 10 plants for boils, 4 plants for different types of sore, 2 plants for ringworm, intertrigo, eczema and pruritus respectively. As *Caesalpinia mimosoides* and *Basella alba* in the treatment of boils, *Hygrophila schulli* for inter trigo, *Cissus discolor* for ringworm, *Mammea suriga* for eczema scored high FL and high Np value, they can be considered as important species.

Conclusions: The documentation and data analysis of the ethnomedicinal knowledge in the coastal regions of Uttara Kannada district of Central Western Ghats have provided the information about important plants in the treatment of different types of skin diseases. Further scientific analysis of such plants may provide novel compounds for the treatment of skin diseases.

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1. Introduction

India has the ancient indigenous knowledge of medicinal and herbal medicines accumulated through many centuries. This knowledge of curing human illness is based on different Indian systems of medicine, practiced by various communities such as

Ayurveda, Unani and Siddha (Gadgil, 1996). It is estimated that in India, traditional healers use around 2500 plant species in the preparation of traditional medicine (Pei, 2001). In recent years, there has been a tremendous range of interest in the medicinal plants especially those used in Ayurveda and other traditional systems of medicines. Allopathic drugs have brought a revolution throughout the world but the plant based medicines have their own unique status (Korpenwar, 2012). Medicinal plants form the only easily accessible alternative health care for the most of our population in rural and tribal areas (Choudhary et al., 2011).

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People of the developing countries rely quite effectively on traditional medicine for primary health care (Sullivan and Shealy, 1997; Singh, 2002).

The Western Ghats, one of the world's ten "Hottest biodiversity hotspots", constitute a mountain range along the western side of India and has over 5000 species of flowering plants (Myers et al., 2000). The forests and hills of this region is a treasure house of about 700 medicinal plants (Padmavathy and Mekala, 2013). The Western Ghats is classified into three regions, viz., South (8°N to 12°N), Central (12°N to 16°N) and North (16°N to 21°N) Western Ghats (Dahanukar et al., 2004). The Central Western Ghat range includes the Uttara Kannada (former North Canara) and some parts of Dakshina Kannada (former South Canara) districts. These two districts are joined by narrow coastal belt of Arabian Sea towards the west and unbroken stretch of the Western Ghats towards the East (Kamath, 1985). Many attempts have been made to document the traditional medicine knowledge in Uttara Kannada district. These studies focused on the indigenous knowledge of different communities like Gawlis, Siddis, Kunbis and Kare-vokkaligas as community based studies (Bhandary et al., 1995, 1996; Harsha et al., 2002; Achar et al., 2010), on specific human ailments like poisonous snake bites, skin diseases, reproductive health, herpes, bone fracture and wounds (Bhandary and Chandrashekhar, 2001; Harsha et al., 2003; Hegde et al., 2007; Bhandary and Chandrashekhar, 2011; Upadhya et al., 2012; Bhat et al., 2012), on veterinary ailments (Bhandary and Chandrashekhar, 2003; Harsha et al., 2005). Use of medicinal plants in coastal Karnataka by various ethnic communities is listed by Bhandary and Chandrashekhar, (2002). Harsha et al., (2003) have documented the ethnomedicinal knowledge in the treatment of skin diseases from upper ghat region of Uttara Kannada district. There is no specific documentation on the traditional treatment methods to cure skin diseases by different communities in the below ghat regions. The present paper aims to highlight the first hand information on traditional methods to cure skin diseases by different communities in the coastal parts of Uttara Kannada district, located in Central Western Ghats of Karnataka.

2. Materials and methods

2.1. Study area

Uttara Kannada district is situated between 13°55' to 15°31'N and 74°9' to 75°10'E with an area 10, 327 km². Present study was carried out in five coastal taluks, viz Karwar, Ankola, Kumta, Honnavar and Bhatkal of Uttara Kannada district (Fig. 1). The soil type is alluvial throughout the coastal region and mostly lateritic, sandy red and black towards the interior margin. The average rainfall is 2835 mm per annum. The temperature remains moderate throughout the year. It fluctuates between 37 °C in mid-summer to 15 °C in winter. The floristic composition shows much diversification similar to its geographical and physiographical patterns. It is classified as (a) Littoral vegetation, (b) Tropical evergreen vegetation, (c) Tropical Moist deciduous forests and (d) Tropical Scrub and thorny forests (Kamath, 1985).

2.2. People communities of the study area

The people of the study area represent a mixture of rich ethnic and cultural diversity. Total population of the area is 1.437 million of which 70.86% of population lives in rural areas (Census of Uttara Kannada District, 2013, <http://www.census2011.co.in>). Kannada, Konkani and Marathi are the major languages. Siddis, Gowlis,

Kunbis, Halakki Okkaligas and Kare Okkaligas are the important tribal communities. Halakki Okkaligas are one of the earlier settlers in the Uttara Kannada district and are said to have come from Tirupati of Andhra Pradesh state. Now they are confined to the coastal taluks of Uttara Kannada district. Siddis are the scheduled tribe of African origin and were brought by the Portuguese as slaves in the coastal regions of western India and majority of them are now settled in the Uttara Kannada district. The mixed marathi speaking Kunbis have migrated from Goa and settled here long back. Similarly the Gowlis are the migrants from Maharashtra. Havyaka Brahmins, Saraswatas, Nayaks, Harijanas, Idigas and Nadavas are the other ethnic communities of this region. Amongst these, the Havyaka Brahmin community was more civilized and scholarly community. It is believed that they have been brought here by the Kadamba king, Mayura Varma, for performing sacrificial rituals. Agriculture is the main occupation of all these communities (Gauniyal et al., 2010). The herbal healers of all these communities have developed the practical knowledge about the medicinal plants through their forefathers and some of them practicing it as a profession. They are practicing it individually. But, use of some plants during the drug formulations in different communities is same as a result of inter-community interactions.

2.3. Sampling techniques and data collection

Field Studies were conducted in regular intervals in different seasons between 2010 and 2013 to collect the primary data. The identification of the 'key informants' (Martin, 1995) in the treatment of skin diseases is based on the information obtained from the patients attending the healers and discussion with the elderly local village people. The information was collected from the informants through semi-structured open ended interviews with questionnaire (Appendix A) as suggested by Martin (1995). The objective of the study was explained to the healers. Information was collected in the local Kannada language and then translated to English. The consent of the informants was taken to share their knowledge about the plants they use to cure the diseases and then their experience in the field of treatment, causes and symptoms of the ailments they treat, average number of patients they treat per week, vernacular names, parts of the plants used and other ingredients added during the drug formulations were noted down. During the survey, depending on the convenience of the practitioner, guided field walk method (Martin, 1995; Maundu, 1995) was followed. A walk through the forest with the healers allowed for both confirmations of the medicinal plants they use for the treatment and the detailed information gathering. Each informant was interviewed more than twice and only those formulations having consistency were considered.

2.4. Identification and preparation of voucher specimens

Plants collected with the herbal healers during the guided field walk were authentically identified with the help of standard floras such as Flora of Presidency of Bombay (Cooke, 1967), Flora of British India (Hooker, 1998), Flora of Presidency of Madras (Gamble, 1984), Flora of Karnataka (Saldahna, 1984) etc. The recent names of the plants have been given according to the Flora of Kerala (Nayar et al., 2006) and The Plant List (2010). All medicinal plants recorded for the treatment of skin diseases were photographed in the field; voucher specimens were made subsequently and are deposited in the Herbarium, P.G. Department of Botany, Karnatak University, Dharwad with accession numbers (PB/GRH 1 to 160).

Table 1
Plants used in the treatment of skin diseases.

Sl. no.	Species/voucher specimen number	Family	Parts used	Habit/habitat	ΣU_i	n	UV	Recommended uses from our study
1.	<i>Acacia catechu</i> (L.f.) Willd. PB/GRH. 48	Mimosaceae	R,W	T/Wi	1	1		Pruritus
2.	<i>Achyranthes aspera</i> L. PB/GRH. 78	Amaranthaceae	L,W	H/Wi	2	3	0.67	Boils, eczema
3.	<i>Adhathoda zeylanica</i> Medikus PB/GRH. 49	Acanthaceae	L,S	Sh/Wi	1	1		Scabies
4.	* <i>Aloe vera</i> (L.) Burm. f. PB/GRH. 107	Liliaceae	L	H/Wi	1	3	0.33	All types of skin diseases
5.	<i>Amaranthus tricolor</i> L. PB/GRH. 108	Amaranthaceae	Sd, W	H/Cu	2	3	0.67	Dandruff, ringworm
6.	<i>Ardisia solanacea</i> Roxb. PB/GRH. 109	Myrsinaceae	R	Sh/Wi	1	1		Itching due to impure blood
7.	<i>Aristolochia indica</i> L. PB/GRH. 110	Aristolochiaceae	R	Sh/Wi	2	5	0.40	Pruritus, septic due to skin allergies
8.	<i>Azadirachta indica</i> A. Juss. PB/GRH. 34	Meliaceae	L	T/Wi	2	2	1.00	Ringworm, scabies
9.	<i>Barringtonia racemosa</i> (L.) Sprengel PB/GRH. 50	Barringtoniaceae	A	T/Wi	1	1		Septic due to skin allergy
10.	<i>Basella alba</i> L. PB/GRH. 150	Basellaceae	L	H/Cu	1	5	0.20	Boils
11.	<i>Biophytum reinwardtii</i> (Zucc.) Klotz. PB/GRH. 151	Oxalidaceae	W	H/Wi	1	1		Scabies
12.	<i>Butea monosperma</i> (Lam.) Taubert PB/GRH. 110	Fabaceae	B	T/Wi	1	1	1.00	Bed sore
13.	<i>Caesalpinia mimosoides</i> Lam. PB/GRH. 111	Caesalpinaceae	Tl	Sh/Wi	1	6	0.16	Boils
14.	<i>Callicarpa tomentosa</i> (L.) Murray PB/GRH. 112	Verbenaceae	L	Sh/Wi	2	2	1.00	Boils, eczema
15.	<i>Calophyllum inophyllum</i> L. PB/GRH. 113	Clusiaceae	B	T/Wi	1	1		Scabies
16.	<i>Calotropis gigantea</i> (L.) R. Br. PB/GRH. 79	Asclepiadaceae	L,R	Sh/Wi	4	4		Eczema, herpes, pruritus, scabies
17.	<i>Careya arborea</i> Roxb. PB/GRH. 35	Lecythidaceae	B	T/Wi	2	4	0.50	Bed sore, sore in intestine
18.	* <i>Carica papaya</i> L. PB/GRH. 114	Caricaceae	L	T/Cu	1	4	0.25	Ringworm
19.	<i>Cassia fistula</i> L. PB/GRH. 63	Caesalpinaceae	B, L, Fr	T/Wi	5	4	1.25	Itching due to impure blood, eczema, herpes, ringworm, scabies
20.	<i>Cassia tora</i> L. PB/GRH. 152	Caesalpinaceae	W, L	H/Wi	3	3	1.00	All types of skin diseases, dermatitis, ringworm
21.	* <i>Cayratia elongata</i> (Roxb.) Susseng. PB/GRH. 153	Vitaceae	R	Li/Wi	1	1		Inter trigo
22.	<i>Celastrus paniculatus</i> Willd. PB/GRH. 115	Celastraceae	R	Cl/Wi	1	1		Itching due to impure blood
23.	<i>Centella asiatica</i> (L.) Urban PB/GRH. 116	Apiaceae	W	H/Wi	2	2	1.00	Dandruff, ringworm
24.	<i>Cinnamomum verum</i> J. S. Presl PB/GRH.117	Lauraceae	B	T/Cu	1	1		Boils
25.	<i>Cissus discolor</i> Blume PB/GRH. 118	Vitaceae	W	Cl/Wi	1	5	0.20	Ringworm
26.	* <i>Citrus aurantifolia</i> (Christm. & Panzer) Swingle PB/GRH. 59	Rutaceae	Fr	T/Cu	1	3	0.33	Boils
27.	<i>Clerodendrum infortunatum</i> L. PB/GRH. 52	Verbenaceae	L	Sh/Wi	1	1		Scabies
28.	<i>Coccinia grandis</i> (L.) Voigt PB/GRH. 119	Cucurbitaceae	L	Cl/Wi	1	1		Boils
29.	<i>Crinum asiaticum</i> L. PB/GRH. 120	Liliaceae	L	H/Wi	1	2	0.50	Eczema
30.	<i>Crossandra infundibuliformis</i> (L.) Nees PB/GRH. 121	Acanthaceae	L	Sh/Wi	2	2	1.00	Eczema, scabies
31.	<i>Cryptolepis buchananii</i> R. Br. Ex Roemer & Schultes PB/GRH. 12	Asclepiadaceae	R,B	Cl/Wi	4	3	1.33	Eczema, herpes, pruritus, scabies
32.	<i>Cuminum cyminum</i> L. PB/GRH. 91	Apiaceae	Sd	H/Cu	1	2	0.50	Ear sore
33.	<i>Curcuma longa</i> L. PB/GRH. 104	Zingiberaceae	Rh	H/Cu	5	6	0.83	All types of skin diseases, eczema, inter trigo, bed sore, scabies
34.	<i>Cyclea peltata</i> (Poiret) Hook.f. & Thomson PB/GRH. 122	Menispermaceae	L	Cl/Wi	1	4	0.25	Boils
35.	<i>Cynodon dactylon</i> (L.) Pers. PB/GRH. 65	Poaceae	W	H/Wi	1	3	0.33	Sore nose
36.	* <i>Dendranthema indicum</i> (L.) Des Moul. PB/GRH. 53	Asteraceae	L	H/Cu	1	1		Boils
37.	<i>Dillenia pentagyna</i> Roxb. PB/GRH.123	Dilleniaceae	B	T/Wi	1	1		Eczema
38.	<i>Diospyros montana</i> Roxb. PB/GRH. 124	Ebenaceae	B,R	T/Wi	2	3	0.66	Eczema, skin sore
39.	<i>Diploclisia glaucescens</i> (Blume) Diels PB/GRH. 81	Menispermaceae	R	Li/Wi	4	3	1.33	Herpes, inter trigo, pruritus, scabies
40.	<i>Dracaena terniflora</i> Roxb. PB/GRH. 125	Liliaceae	R	Sh/Wi	1	1		Bed sore
41.	<i>Eclipta prostrata</i> (L.) L. PB/GRH. 126	Asteraceae	L	H/Wi	1	1		Dandruff
42.	<i>Erythrina variegata</i> L. PB/GRH. 127	Fabaceae	L,B	T/Wi	4	5	0.80	Boils, pruritus, scabies, septic due to skin allergies
43.	<i>Ficus exasperata</i> Vahl PB/GRH. 128	Moraceae	B,R,L	T/Wi	4	1	0.36	Eczema, pruritus, ringworm, scabies
44.	<i>Ficus religiosa</i> L. PB/GRH. 129	Moraceae	L	T/Wi	1	3	0.33	Pruritus
45.	<i>Girardinia diversifolia</i> (Link.) Friis PB/GRH. 45	Urticaceae	R	H/Wi	3	2	1.50	Herpes, pruritus, scabies
45.	* <i>Hibiscus rosa-sinensis</i> L. PB/GRH. 13	Malvaceae	L	Sh/Cu	1	1		Boils
47.	<i>Holarrhena pubescence</i> (Buch.- Ham.) Wallich ex G. Don PB/GRH. 36	Apocynaceae	R,B	T/Wi	2	2	1.00	Eczema, pruritus
48.	* <i>Hydnocarpus pentandra</i> (Ham.) Oken PB/GRH. 154	Flacourtiaceae	Sd	T/Wi	1	1		Scabies
49.	<i>Hygrophila schullii</i> (Ham.) M.R. Almeida & S.M. Almeida PB/GRH. 155	Acanthaceae	R	H/Wi	1	5	0.20	Inter trigo
50.	<i>Ixora arborea</i> Roxb. ex Smith PB/GRH. 130	Rubiaceae	R,B	T/Wi	1	1		Leucoderma
51.	<i>Jasminum grandiflorum</i> L. PB/GRH. 131	Oleaceae	L	Cl/Cu	2	2	1.00	Boils, eczema
52.	* <i>Jatropha curcas</i> L. PB/GRH. 103	Euphorbiaceae	B	Sh/Wi	1	1		Eczema
53.	* <i>Kalanchoe pinnata</i> (Lam.) Pers. PB/GRH. 19	Crassulaceae	L	H/Wi	2	4	0.50	Eczema, pruritus
54.	<i>Lobelia nicotianifolia</i> Roth ex Roemer & Schultes var. <i>nicotianifolia</i> PB/GRH. 133	Companulaceae	R	Sh/Wi	1	1		Boils
55.	<i>Macaranga peltata</i> (Roxb.) Muell - Arg. PB/GRH. 134	Euphorbiaceae	L	T/Wi	1	3	0.33	Boils
56.	<i>Madhuca indica</i> J. Gmelin PB/GRH. 71	Sapotaceae	B	T/Wi	2	2	1.00	Itching due to impure blood, bed sore
57.	* <i>Mammea suriga</i> (Buch.- Ham. ex Roxb.) Kosterm. PB/GRH. 135	Clusiaceae	B,Fb	T/Wi	1	4	0.25	Eczema
58.	<i>Mangifera indica</i> L. PB/GRH. 136	Anacardiaceae	B	T/Wi	3	4	0.75	Pruritus, scabies, septic due to skin allergies
59.	* <i>Mimosa pudica</i> L. PB/GRH. 31	Mimosaceae	W	H/Wi	2	2	1.00	Dermatitis, ringworm
60.	<i>Momordica dioica</i> Roxb. ex Willd. PB/GRH. 54	Cucurbitaceae	R	Cl/Wi	1	2	0.50	Boils
61.	* <i>Moringa oleifera</i> Lam. PB/GRH. 72	Moringaceae	L	T/Cu	1	3	0.33	Sore at the tip of penis
62.	<i>Musa paradisiaca</i> L. PB/GRH. 156	Musaceae	L	H/Cu	1	1		Boils
63.	<i>Naravelia zeylanica</i> (L.) DC. PB/GRH. 85	Ranunculaceae	R	Cl/Wi	1	4	0.25	Sore in buccal cavity
64.	* <i>Naregamia alata</i> Wight & Arn. PB/GRH. 137	Meliaceae	W,R	H/Wi	3	2	1.50	Eczema, pruritus, scabies
65.	<i>Nelumbo nucifera</i> Gaertner PB/GRH. 157	Nymphiaceae	Tu, L	Aq,H/Wi	1	1		Boils
66.	<i>Neolamarckia cadamba</i> (Roxb.) Bosser PB/GRH. 15	Rubiaceae	B	T/Wi	1	1		Measles

Table 1 (continued)

Sl. no.	Species/voucher specimen number	Family	Parts used	Habit/habitat	$\sum U_i$	n	UV	Recommended uses from our study
67.	<i>Ocimum americanum</i> L. PB/GRH. 139	Lamiaceae	L	H/Wi	2	3	0.66	Dandruff, dark pigmentation on skin
68.	<i>Ocimum tenuiflorum</i> L. PB/GRH. 94	Lamiaceae	L	H/Cu	1	1		Dermatitis
69.	<i>Paramignya monophylla</i> Wight PB/GRH. 140	Rutaceae	R	Cl/Wi	1	1		Boils
70.	<i>Pavetta indica</i> L. var. <i>indica</i> PB/GRH. 141	Rubiaceae	R	Sh/Wi	1	1		Eczema
71.	<i>Piper nigrum</i> L. PB/GRH. 106	Piperaceae	Fr	Cl/Wi	6	7	0.85	Dandruff, pruritus, scabies, eczema, bed sore, boils
72.	* <i>Plectranthus amboinicus</i> (Lour.) Sprengel PB/GRH. 1	Lamiaceae	L	H/Cu	1	1		Bed sore
73.	<i>Plumbago indica</i> L. PB/GRH. 142	Plumbaginaceae	R	H/Wi	1	1		Eczema
74.	<i>Plumbago zeylanica</i> L. PB/GRH. 5	Plumbaginaceae	R	H/Wi	1	1		Eczema
75.	<i>Plumeria rubra</i> L. PB/GRH. 87	Apocynaceae	La	T/Cu	1	1		Scabies
76.	<i>Pongamia pinnata</i> (L.) Pierre PB/GRH. 9	Fabaceae	R	T/Wi	3	2	1.50	pruritus, scabies, herpes
77.	** <i>Psychotria dalzellii</i> Hook.f. PB/GRH. 96	Rubiaceae	S	Sh/Wi	1	3	0.33	Pruritus
78.	<i>Randia dumetorum</i> (Retz.) Poir PB/GRH. 88	Rubiaceae	R	Sh/Wi	3	2	1.50	Herpes, Pruritus, Scabies
79.	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz PB/GRH. 105	Apocynaceae	R	H/Wi	3	3	1.00	Herpes, pruritus, scabies
80.	<i>Rhinacanthus nasuta</i> (L.) Kurz PB/GRH. 66	Acanthaceae	L	H/Wi	1	1		Leucoderma
81.	<i>Rhynchosyris retusa</i> (L.) Blume	Orchidaceae	L, Fr	Ep.H/Wi	1	2	0.50	Ear sore
82.	<i>Sapindus trifoliata</i> L. PB/GRH. 55	Sapindaceae	Fr	T/Wi	1	1		Pruritus
83.	<i>Saraca asoca</i> (Roxb.) de Wilde PB/GRH. 143	Caesalpiniaceae	B	T/Wi	1	1		Bed sore
84.	<i>Securinega leucopyrus</i> (Willd.) Muell. PB/GRH. 144	Euphorbiaceae	L	Sh/Wi	2	2	1.00	Boils, Eczema
85.	<i>Sesamum orientale</i> var. <i>malabaricum</i> Nan. PB/GRH. 20	Pedaliaceae	Sd	H/Cu	1	1		Dandruff
86.	<i>Solanum nigrum</i> L. PB/GRH. 145	Solanaceae	L	H/Wi	1	1		Eczema
87.	<i>Spondius pinnata</i> (L. f.) Kurz PB/GRH. 158	Anacardiaceae	B	T/Wi	1	2	0.50	Boils
88.	<i>Strychnos nux-vomica</i> L. PB/GRH. 101	Loganiaceae	B	T/Wi	1	4	0.25	Boils
89.	* <i>Syzygium aromaticum</i> (L.) Merr. & Perry PB/GRH. 100	Myrtaceae	Fb	T/Cu	5	5	1.00	Dandruff, pruritus, scabies, eczema, bed sore
90.	<i>Tabernaemontana divaricata</i> (L.) R.Br. Ex Roemer & Schultes PB/GRH. 17	Apocynaceae	L	Sh/Cu	1	1		boils
91.	** <i>Tabernaemontana heyneana</i> Wallich PB/GRH. 102	Apocynaceae	R,B	T/Wi	4	4	1.00	Herpes, pruritus, scabies, skin sore
92.	<i>Tagetes erecta</i> L. PB/GRH. 24	Asteraceae	L	Sh/Cu	1	1		boils
93.	<i>Tectona grandis</i> L. f. PB/GRH. 77	Verbenaceae	W, TI	T/Wi	2	3	0.67	All types of skin diseases, inter trigo
94.	<i>Terminalia chebula</i> Retz. PB/GRH. 98	Combretaceae	Fr	T/Wi	1	4	0.25	Inter trigo
95.	<i>Terminalia cuneata</i> Roth PB/GRH. 159	Combretaceae	B	T/Wi	1	2	0.50	Itching due to impure blood
96.	<i>Triticum aestivum</i> L. PB/GRH. 146	Poaceae	Sd	H/Cu	1	1		Boils
97.	<i>Vernonia anthelmintica</i> (L.) Willd PB/GRH. 93	Asteraceae	Sd	H/Cu	6	6	1.00	All types of skin diseases, eczema, pruritus, scabies, bed sore, dandruff
98.	<i>Vigna radiata</i> (L.) Wil Czek PB/GRH. 147	Fabaceae	Fr	H/Cu	1	1		Boils
99.	* <i>Vitis vinifera</i> L. PB/GRH. 160	Vitaceae	Fr	Cl/Cu	1	1		Itching due to impure blood
100.	<i>Wattakaka volubilis</i> (L.f.) Stapf PB/GRH. 90	Asclepiadaceae	R, S, Fr	Sh/Wi	1	1		Inter trigo
101.	<i>Ziziphus rugosa</i> Lam. PB/GRH. 148	Rhamnaceae	R	Sh/Wi	1	3	0.33	Boils
102.	<i>Ziziphus xylopyrus</i> (Retz.) Willd. PB/GRH. 149	Rhamnaceae	L,B	Sh/Wi	1	3	0.33	Boils

$\sum U_i$ —Total number of uses mentioned by the informants for a given species, n—total number of informants for a given species, W—whole plant, R—root, L—leaves, TI—tender leaves, S—stem, Br—branch of the leaves, Tf—tender fruit, B—bark, Fl—flower, Fr—fruit, Fb—flower bud, Sd—seed, Rh—rhizome, Bu—bulb, Su—sucker, Tu—tuber, SuSt—succulent stem, La—latex, T—tree, Sh—shrub, H—herb, P—parasite, Wi—wild, Cu—cultivated.

* Exotic.

** Endemic.

Table 2 Informants consensus factor for different skin diseases (ICF).

Sl. no	Category	Use citation (Nur)	Number of plant taxa used (Nt)	ICF
1.	Ringworm	18	9	0.52
2.	Intertrigo	13	7	0.50
3.	Boils	45	28	0.38
4.	Sore	23	17	0.27
5.	Dermatitis and skin pigmentations	5	4	0.25
6.	Septic due to skin allergies and itching due to impure blood	12	10	0.18
7.	Dandruff	1	8	0.00
8.	Eczema	10	25	0.00
9.	Herpes	2	9	0.00
10.	Leucoderma	2	2	0.00
11.	Measles	1	1	0.00
12.	Pruritus	12	21	0.00
13.	Scabies	11	28	0.00

a particular plant) and the number of uses cited by the informants (Byg and Baslev, 2001). The use value (UV), a quantitative method that demonstrates the relative importance of a species known

locally, was calculated according to the following modified Phillips and Gentry (1993a, 1993b) formula:

$UV = \sum U_i/n$ (Albuquerque et al., 2006). Where 'U_i' is the number of uses to treat the different types of skin diseases mentioned by each informant for a given species; 'n' is the total number of informants.

2.5.2. Informants consensus factor (ICF)

For the data analysis, informant consensus factor (ICF) was employed to find out the homogeneity in the information given by the informants. All the citations were placed into 13 different types of skin ailment categories. The total number of use citations and total number of plants claimed for each category is calculated (Table 2). ICF values will be low (near 0), if plants are chosen randomly or if informants do not exchange information about their use. Values will be high (near or more than 1), if there is a well defined selection criterion in the community and/or if information is exchanged between informants.

The ICF is calculated by the following formula (Gazzaneo et al., 2005):

$ICF = Nur/Nt/Nur-1$. Where 'Nur' is the number of use citations in each category of skin disease and 'Nt' is the number of species used.

Table 3
Fidelity level of the plants with higher ICF values.

Plant name	Disease with highest ICF value	Np	N	FL (%)
<i>Achyranthes aspera</i> L.	Boils	2	3	67
<i>Amaranthes tricolor</i> L.	Ringworm	2	3	67
<i>Aristolochia indica</i> L.	Septic due to skin allergies	3	5	60
<i>Azadirachta indica</i> A. Juss.	Ringworm	1	2	50
<i>Basella alba</i> L.	Boils	5	5	100
<i>Caesalpinia mimosoides</i> Lam.	Boils	6	6	100
<i>Callicarpa tomentosa</i> (L.) Murray	Boils	1	2	50
<i>Careya arborea</i> Roxb.	Sore in intestine	3	4	75
<i>Carica papaya</i> L.	Ringworm	4	4	100
<i>Centella asiatica</i> (L.) Urban	Ringworm	1	2	50
<i>Cissus discolor</i> Blume	Ringworm	5	5	100
<i>Citrus aurantifolia</i> (Christm. & Panzer) Swingle	Boils	3	3	100
<i>Cuminum cyminum</i> L.	Ear sore	2	2	100
<i>Cyclea peltata</i> (Poirlet) Hook.f. & Thomson	Boils	4	4	100
<i>Cynodon dactylon</i> (L.) Pers.	Sore nose	3	3	100
<i>Diospyros montana</i> Roxb.	Skin sore	3	4	75
<i>Hygrophila schulli</i> (Ham.) M.R. Almeida & S.M. Almeida	Intertrigo	5	5	100
<i>Jasminum grandiflorum</i> L.	Boils	1	2	50
<i>Macaranga peltata</i> (Roxb.) Muell-Arg.	Boils	3	3	100
<i>Madhuca indica</i> J. Gmelin	Skin sore	1	2	50
<i>Mangifera indica</i> L.	Septic due to skin allergies	2	4	50
<i>Momordica dioica</i> Roxb. ex Willd.	Boils	2	2	100
<i>Mimosa pudica</i> L.	Ringworm	1	2	50
<i>Moringa oleifera</i> Lam.	Sore at the tip of penis	3	3	100
<i>Naravelia zeylanica</i> (L.) DC.	Sore in buccal cavity	4	4	100
<i>Rhynchosyilis retusa</i> (L.) Blume	Ear sore	2	2	100
<i>Securinega leucopyrus</i> (Willd.) Muell.	Boils	1	2	50
<i>Spondius pinnata</i> (L. f.) Kurz	Boils	2	2	100
<i>Strychnos nux-vomica</i> L.	Boils	4	4	100
<i>Tectona grandis</i> L. f.	Intertrigo	2	3	67
<i>Terminalia chebula</i> Retz.	Intertrigo	4	4	100
<i>Ziziphus rugosa</i> Lam.	Boils	3	3	100
<i>Ziziphus xylopyrus</i> (Retz.) Willd.	Boils	3	3	100

'Np' the number of informants who independently suggested the use of a plant species for a particular skin disease (use mention).

'N' the total number of informants who mentioned the same plant for other skin diseases.

Table 4
Fidelity level of the plants with lower ICF values.

Plant name	Disease with Lower ICF value	Np	N	FL (%)
<i>Azadirachta indica</i> A. Juss.	Scabies	1	2	50
<i>Callicarpa tomentosa</i> (L.) Murray	Eczema	1	2	50
<i>Centella asiatica</i>	Dandruff	1	2	50
<i>Crinum asiaticum</i> L.	Eczema	2	2	100
<i>Crossandra infundibuliformis</i> (L.) Nees	Eczema	1	2	50
<i>Ficus religiosa</i> L.	Scabies	1	2	50
<i>Holarrhena pubescence</i> (Buch.- Ham.) Wallich ex G. Don	Pruritus	3	3	100
	Eczema	1	2	50
	Pruritus	1	2	50
<i>Jasminum grandiflorum</i> L.	Eczema	1	2	50
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Pruritus	3	4	75
<i>Madhuca indica</i> J. Gmelin	Itching due to impure blood	1	2	50
<i>Mammea suriga</i> (Buch.- Ham. ex Roxb.) Kosterm.	Eczema	4	4	100
<i>Mimosa pudica</i> L.	Dermatitis	1	2	50
<i>Naregamia alata</i> Wight & Arn.	Scabies	2	4	50
<i>Psychotria dalzellii</i> Hook.f.	Pruritus	3	3	100
<i>Securinega leucopyrus</i> (Willd.) Muell.	Eczema	1	2	50

'Np' the number of informants who independently suggested the use of a plant species for a particular skin disease (use mention).

'N' the total number of informants who mentioned the same plant for other skin diseases.

2.5.3. Fidelity level (FL)

The fidelity level (FL), the percentage of informants claiming the use of a certain plants for the same major purpose, was calculated according to the following formula (Alexiades and Sheldon, 1996):

$FL (\%) = Np/N \times 100$. 'Np' is the number of informants who independently suggested the use of a plant species for a particular skin disease (Use mention); 'N' is the total number of informants who mentioned the same plant for any skin diseases.

3. Results and discussion

3.1. Medicinal plants and their uses reported by the informants

In all, 48 informants were interviewed. Among them 38 (36 male and 2 female individuals, aged between 31 and 78 years) are the 'key informants' who gave the information exclusively about the treatment of skin diseases. Survey of the study area indicated ethnomedicinal information of 102 plant taxa belonging to 95

Table 5
Correlation between fidelity level (FL) and use mention (Np) of the plants.

A) Plants with high fidelity level and low use mention for a particular disease

Careya arborea, FL=75%, Np=3, Sore in intestine
Citrus aurantifolia, FL=100%, Np=3, Boils
Crinum asiaticum, FL=100%, Np=2, Eczema
Cuminum cyminum, FL=100%, Np=2, Ear sore
Cynodon dactylon, FL=100%, Np=3, Sore nose
Diospyros montana, FL=75%, Np=3, Skin sore
Ficus religiosa, FL=100%, Np=3, Pruritus
Kalanchoe pinnata, FL=75%, Np=3, Pruritus
Macaranga peltata, FL=100%, Np=3, Boils
Momordica dioica, FL=100%, Np=2, Boils
Moringa oleifera, FL=100%, Np=3, Sore at the tip of penis in the children
Psychotria dalzellii, FL=100%, Np=3, Pruritus
Rhynchosytilis retusa, FL=100%, Np=2, Ear sore
Spondius pinnata, FL=100%, Np=2, Boils
Ziziphus rugosa, FL=100%, Np=3, Boils
Ziziphus xylopyrus, FL=100%, Np=3, Boils

B) Plants with high fidelity level and high use mention for a particular disease

Basella alba, FL=100%, Np=5, Boils
Caesalpinia mimosoides, FL=100%, Np=6, Boils
Carica papaya, FL=100%, Np=4, Ringworm
Cissus discolor, FL=100%, Np=5, Ringworm
Cyclea peltata, FL=100%, Np=4, Boils
Hygrophila schullii, FL=100%, Np=5, Intertrigo
Mammea suriga, FL=100%, Np=4, Eczema
Naravelia zeylanica, FL=100%, Np=4, Sore in buccal cavity
Strychnos nux-vomica, FL=100%, Np=4, Boils
Terminalia chebula, FL=100%, Np=4, Intertrigo

genera of 56 families to treat different types of skin diseases. Few of the herbal healers considered their herbal knowledge as traditional secrets and did not easily part with it till intimate contacts were established with them. The traditional healers were not pressurized to reveal their knowledge and were convinced that the information would be exclusively for academic purpose. The first hand information collected from them by repeated visits included treatment for 15 different types of human skin infections viz. ringworm, intertrigo, boils, sores, dermatitis, skin pigmentation, septic due to skin allergies, itching due to impure blood, dandruff, eczema, herpes, leucoderma, measles, pruritus and scabies.

3.2. Method of preparation and mode of administration

Traditional practitioners usually prefer external and internal applications or oral administration of the herbal preparations in the treatment of various types of skin ailments depending on the type and severity of the infection. The drug formulations are usually *Paste* of the drug parts with water, lime juice, lime water, rice washed water, coconut water, butter, ghee, milk obtained from coconut gratings, coconut oil, jaggery, honey, cow's milk or cow's urine; *extraction* of oil from the drug parts; *juice extract* from fresh juicy parts or with water; *application of exudates* of raw materials like latex; *decoctions and infusions* of drug parts with water; *roasted and powdered* raw plant material; *fried* plant material with coconut oil, ghee etc and *ash* of the burnt drug part. The external application of the drug is used for all types of skin ailments except in the treatment of itching due to impure blood. The internal use of plant medicines is for sores in nose, buccal cavity or ear. Oral administration is for boils, itching due to impure blood, eczema, herpes, measles, pruritus, scabies, septic due to skin allergies and intestinal sore. Treatments are done with either single plant formulation, combinations of several plants or even with many parts of the same plant (Appendix C). Out of 82, 30 formulations involved multiple drugs obtained from two to twelve different plant species. According to the herbal healers, the combinations of different plant species increases the activity of medicine and 'ill

effect' of any plant (if any) will be 'neutralized' by the other (Bhat, et al., 2012). Rapid cure and enhancement of immunity power in the patients is the aim of combinations. Similar concept is reported in the Indian Traditional Systems of medicine like Ayurveda and Siddha (Sivaranjani and Ramakrishnan, 2012).

Some of the formulations involve non-plant materials such as copper sulphate, salt (sodium chloride), jaggery, camphor tablets, lime water, rice washed water, cow's urine, milk, butter and ghee. In some other cases the boiling process and storage of prepared drug is done in the copper vessel and applied topically to treat eczema, skin allergies, scabies and all types of skin diseases. Oral administrations also have the usage of non plant materials along with the plant drug parts. Cow's milk in blood purification, eczema and boils, jaggery in blood purification, ghee in boils, honey in skin allergies and butter milk in intestinal sore. According to the practitioners this addition is to enhance the efficacy of herbal remedies or to make the remedy more palatable and it masks the undesirable taste of the plant drugs when they are taken orally. These non plant materials are used in both external and oral administrations. They play a major role as a media and some of them actively participate in curing the skin infections. Many of these non plant materials have their mention in Indian Materia Medica, such as lime (calcium carbonate) in warts, abrasions, burns, intertrigo of children, erysipelous inflammations, scalds, sore and small pox; copper sulphate in wounds, parasitic diseases of the skin, ringworm, indolent ulcers, leprosy and chronic skin diseases. Storage of water in bright copper vessels (Taamra paatra) was practiced by ancient Hindus due to its believed antiseptic qualities. The 'Taamra-Bhasma' (copper ash) is recommended for local application in leprosy and other skin diseases. Salt powder (sodium chloride), salt water and sea bathing is recommended in the treatment of various types of skin diseases. Similarly cow's milk in ulcers; butter and butter milk in all types of sores; ghee in blisters, irritability of the skin and in leprosy; honey in abscesses, ulcers, sore nipples, bruises and scalds are used (Nadkarni, 2000). The curative property of cow's urine in skin diseases, especially in the treatment of leprosy is reported in *Caraka Samhita* and in other ayurvedic literatures (Sathasivam et al., 2010; Shah et al., 2011).

The antibacterial properties of cow's urine against several human pathogens causing skin diseases is also reported (Jarald et al., 2008; Sathasivam et al., 2010; Shah et al., 2011; Ahuja et al., 2012).

3.3. Analysis of the data

The study reveals that among 102 plants recorded, most of the plants used for the treatment are collected from wild (79 plants; 77.45%). Habit-wise analysis of the plants indicates that trees are highly used followed by herbs and shrubs, while climbers and lianas are less represented (Fig. 2). In most of the case leaves are frequently used plant parts for the drug preparations (Fig. 3). Of all the drug preparations, paste is the most preferred method followed by oil extraction (Fig. 4).

3.3.1. Use value (UV)

As indicated in Table 1, UV is calculated for all the species and the single use by the single informant is not considered for analysis. The plant species, *Pongamia pinnata*, *Naregamia alata*, *Randia dumetorum* and *Girardinia diversifolia* scored a high UV (1.50 each), followed by *Diploclisia glaucescens*, *Cryptolepis buchananii* (1.33 each) and *Cassia fistula* (1.25). Plant with high UV is the

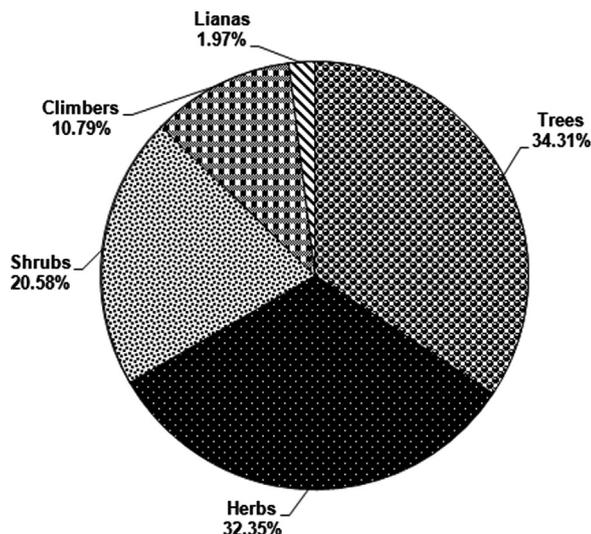


Fig. 2. Habit-wise usage of plants for skin diseases.

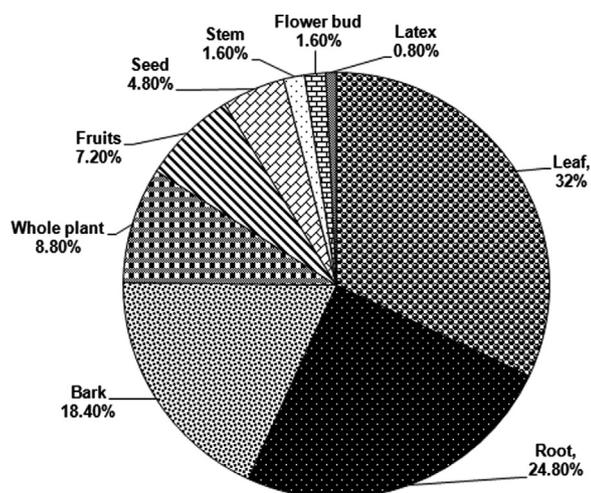


Fig. 3. Percentage of drug parts used for skin diseases.

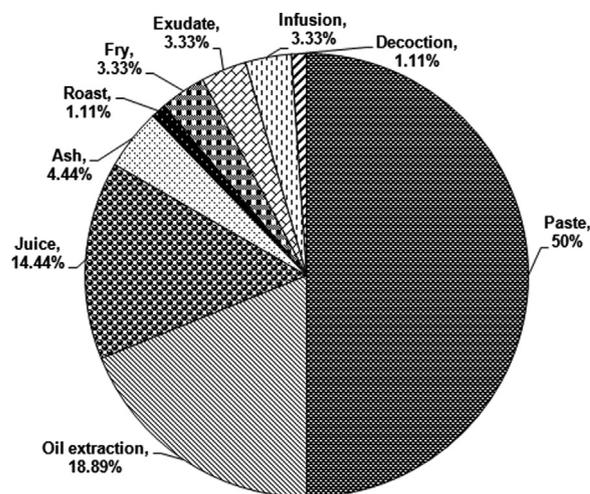


Fig. 4. Percentage of drug formulations for skin diseases.

indication of its importance in the herbal medicine practice as it is highly cited by many informants.

3.3.2. Informants consensus factor (ICF)

The treatment for different types of skin diseases by the herbal healers are classified into 13 categories and the ICF values for each category are given (Table 2). ICF values obtained for the reported categories indicate the degree of shared knowledge for the treatment of each category of ailment. The highest ICF scored is for ringworm (ICF=0.52). Nine plants are used to treat the ailment and were cited by the 18 practitioners. Most of the practitioners quoted about the *Cissus discolor* (leaf) and *Carica papaya* (latex) to treat the ringworm. Intertrigo scored the second highest value of ICF (0.50). It is a very common type of skin infection in the study area during rainy season. Seven plants with 13 citations are recorded to treat the ailment. *Terminalia chebula* (fruit), *Tectona grandis* (tender leaves), *Hygrophylla schulli* (root) are extensively used to treat the infection. Boils recorded the third highest value (ICF=0.38). Twenty eight plants with 45 citations are recorded to treat the ailment. Comparatively low scores are for sore (0.27), dermatitis and skin pigmentations (0.25), septic due to skin allergies and itching due to impure blood (0.18). Dandruff, eczema, herpes, leucoderma, scabies, pruritus and measles scored 'zero' as the informants did not share their knowledge to treat these ailments. ICF value is a proportion between the use of different plants by various herbal healers for a particular disease category suggesting the level of sharing the knowledge about the use of medicinal plants amongst the healers. High ICF value indicates the use of some plants by many healers. Whereas low value means use of different plants by many healers and ICF value would be 'zero' when more plants are employed by few herbal healers.

3.3.3. Fidelity level

We analyzed the disease categories to highlight the most important plant species in each category of skin disease in terms of fidelity level. It is calculated for the plants which are used to treat most frequently reported ailment categories for both higher ICF values (ICF=0.18 and above) and lower ICF values (ICF=0.00), as both have scored a highest fidelity value (50% or above). The plants cited only once by a single informant are not considered for the Fidelity level analysis. In the higher ICF category 10 plants for boils, 4 plants for different types of sore, 2 plants for ringworm and intertrigo respectively scored 100% fidelity level. On the other hand only 2 plants for eczema and pruritus respectively scored 100% fidelity level in case of lower ICF category (Tables 3 and 4).

3.3.4. Correlation between fidelity level and use mention (Np) of the plants

Comparative analysis of the data is an important criterion for evaluating the medicinal value of a particular plant. A correlation between FL and Np carried out by Andrade-Cetto et al. (2006) revealed that, plants with highest FL may score low Np and such plants are of less significance. Whereas, plants which score high FL and high Np for a particular disease are worth taking up for further phytochemical analysis. Similar correlations were found in our study that *Crinum asiaticum* for eczema, *Cuminum cyminum* and *Rhynchosyilis retusa* for ear sore, *Momordica dioica* and *Spondius pinnata* for boils scored high FL but with low Np (Table 5A). *Caesalpinia mimosoides* and *Basella alba* for boils, *Hygrophila schulli* for intertrigo, *Cissus discolor* for ringworm, *Mammea suriga* for eczema can be considered as important species with respect to their high FL and high Np as they are widely used to treat the particular skin diseases and are highly significant (Table 5B).

3.3.5. Other literature reports in the treatment of skin diseases

Collected data is crosschecked with all the available ayurvedic literatures (Sharma et al., 2000, 2001 and 2002; Kirtikar and Basu, 2001; Billore et al., 2003 and 2005; Parrotta, 2001; Kailash Chandra et al., 2007; Sivarajan and Balachandran, 2004; Warriar et al., 2001 and Yoganarasimhan, 1996) and publications on this area of research (Appendix B). From the Ayurvedic literatures it is found that out of 102 species recorded, 76 species are employed in ayurveda to cure different types of skin diseases. *Biophytum reinwardtii*, *Caesalpinia mimosoides*, *Cayratia elongata*, *Crossandra infundibuliformis*, *Dracaena terniflora*, *Girardinia diversifolia*, *Mammea suriga*, *Momordica dioica*, *Paramignya monophylla*, *Psychotria dalzellii*, *Rhynchosyilis retusa* and *Ziziphus xylopyrus* could be considered as new claims for skin diseases as their use has not been mentioned in ayurveda or any other research articles surveyed. *Cayratia elongata*, *Hydnocarpus pentandra*, *Mammea suriga*, *Moringa oleifera*, *Naregamia alata*, *Psychotria dalzellii* and *Tabernaemontana heyneana* are endemic to India (Ahmadullah and Nayar, 1986; Nayar et al., 2006). *Aloe vera*, *Carica papaya*, *Citrus aurantifolia*, *Dendranthema indicum*, *Hibiscus rosa-sinensis*, *Jatropha curcas*, *Kalanchoe pinnata*, *Mimosa pudica*, *Plectranthes amboinicus*, *Syzygium aromaticum* and *Vitis vinifera* have their nativity outside India, but interestingly they are in traditional use in the coastal part of Central Western Ghats. Among these, except *Dendranthema indicum* and *Plectranthes amboinicus*, the other nine species have reported in ayurveda system too (Appendix A).

4. Conclusion

From the present study it can be concluded that the ethnic communities inhabiting in the coastal parts of Uttara Kannada district have sound ethnomedicinal knowledge of curing common skin diseases using natural resources of the Western Ghats around them. The various analysis such as UV, FL and correlative value between UV and Np pointed out the most important plant species in treating the skin diseases. The detailed study of the curative property of the said plants is worth taking up for further scientific analysis, which may provide novel compounds for the treatment of skin diseases. Similarly the ICF value indicated a high degree of sharing the knowledge between the different communities in the treatment of ringworm, intertrigo, boils and sore in the study area. We observed that only 76 plant species out of 102 listed have their mention in ayurveda system of medicine. This indicates that the use of remaining 26 plant species is acquired through the practical experience by the people in Uttara Kannada district.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jep.2013.10.062>.

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