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Quantitative ethnobotanical assessment of Barda Sanctuary, Gujarat, India.

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Abstract- For a long time, ethnomedicinal plants have been crucial for curing many ailments in the world. Maldharies of Barda Sanctuary depending on for the purpose of medicine on plants and most of them having traditional knowledge on how to use different medicinal plants as remedy to treat like cough, fever, asthma, headache and other diseases. This study was started for the identification of medicine men who have been using plants as medicines in Barda Sanctuary, Gujarat, India. And also, to document their traditional knowledge quantitatively on how they utilize ethnomedicinal plants. Field study was performed over the duration of 3 years in Barda Sanctuary. Total information related to the utilization of medicinal plants was gathered with the help of questionnaires and structured interviews with the traditional healers. After collecting the data, it was analysed with the help of use value (UV), informant consensus factor (Fic) and fidelity level (FL). Finally, 51 species of plants having medicinal properties distributing in 47 genus which belonged to 31 plant families were commonly used by Maldhari medicine men of Barda Sanctuary. These plants cured 39 ailments. Total 12 categories of ailment were identified. Most used plant part was leaf. Fic values of this study showed that healers had agreed in using the medicinal plants in curing hair care, liver problems and Genito-urinary problems. Dermatological infections had highest use-reports and 32 plant species had fidelity level of 100% being the highest. From the result the plants, *Maytenus emarginata*, *Mitragyna parvifolia*, *Alstonia scholaris*, *Phyllanthus emblica*, *Eucalyptus camaldulensis*, *Pterocarpus marsupium* and *Mimusops elengi* (having high UV), *Zizyphus nummularia*, *Acacia chundra*, *Carissa congesta*, *Syzygium cumini* and *Tamarindus indica* (having high FL) are recommended for future studies in ethnopharmacology field for discovering medicines.

Key words: Data analysis, Ethnomedicine, Maldharies, Barda sanctuary

INTRODUCTION

According to WHO “Roughly 65-80% of the population of the world in developing countries depends mainly on plants for meeting up their primary health care requirements which is because of the case of poverty and not having the access of modern medicine”.¹ Recently, information of ethnobotany in the research of medicinal plant research has increased in getting a lot of attention in scientific community.² People have started to gain interest

in medicinal plants because prescribed drugs are very costly for maintaining own and well-being and also to bio prospect new drugs derived from plants.³

Looking into History, it is found that most of the medicines were made from plant, it may have been plant parts or much more complex forms like extracts or mixtures. The most important benefits of using medicines which are made directly from plant are that they are comparatively safer than synthetically made drugs. They offer maximum benefits in therapy and they provide affordable treatment.⁴ For nearly 200 years, pharmacopoeia having been

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dominated by medicines made from herbs and rough estimate of worldwide prescribed drugs that is 25% drugs actually came by the use of plants. As WHO said “Out of 252 drugs, which were considered basic and essential, 11% are of exclusive plant origin”.^{5,6}

Last few decades showed that in India the study of traditionally used ethnomedicinal plants has increased a lot. Also, recent study shows increasing use reports of plants which are being utilised by traditional healers of the nomadic tribes.⁷⁻¹¹ Ethnomedicinal uses of plants in Barda Sanctuary were available in scarce amount and all of the studies were having deficiency in analysing the data by not approaching in the quantitative way.^{12,13} This particular research has been done by keeping aim to recognise medicine men among the Maldharies of Barda Sanctuary in Gujarat, India and to quantitatively analyse their traditional knowledge of ethnomedicine with the help of different ethnobotanical tools on how they utilize medicinal plants which are commonly used.

MATERIALS & METHODS

Study area and people

Barda sanctuary present in two districts of Gujarat, namely Porbandar and Jamnagar. This sanctuary cover about 192 sq. km and located between 21°40’-21°55’ N latitude and 69°40’-69°50’ E longitude (Fig. 1). The vegetation is dry and no surplus water is available throughout the year. The study was conducted in ten sites of Barda sanctuary (Adityana, Ajmapat, Dhedhia, Ghumli, Godhana, Kileshwar, Mota jungle, Naliadhar, Sat serda and Sat virda) which are inhabited by Maldharies.

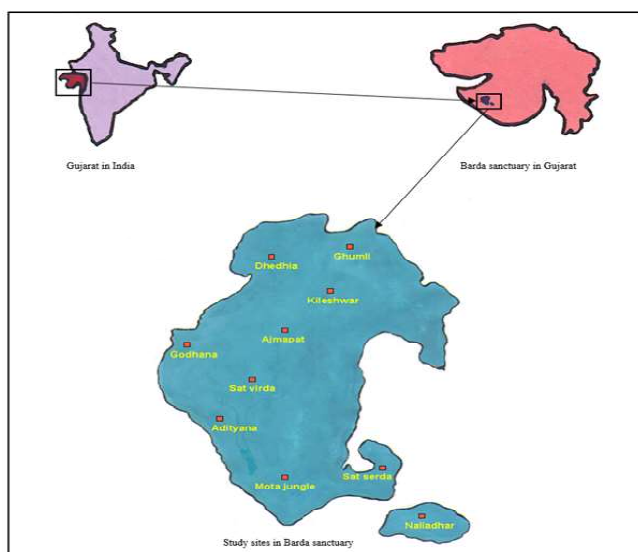


Figure 1. Barda Sanctuary

Maldharies are the indigenous people of the study area, nomads of Gujarat, living predominantly in Barda sanctuary. Maldharies have general knowledge of ethnomedicinal plants. They also know how to make medicines from plants for curing ailments like cough, head ache, fever, etc.

Data collection

The study area investigation was performed for acquiring information from medicine men related to the use of plants. Minimum 7 days were spent with the Maldharies of the Barda Sanctuary during the field visits. It was required to document their traditional knowledge of ethnomedicinal plants, for that a total of 10 field surveys were done during 3 years in Barda sanctuary. 9 traditional healers were interviewed with the help of questionnaires and oral conversations. They have adequate knowledge of ethnomedicinal plants found which they use. Information was recorded about the plants like their local name and which part is utilised to cure disease. Herbarium specimens were collected for the deposition at Department of Life Science of Bhavnagar University, Gujarat, India.

Ailment categories

Total 12 ailment categories were identified by gathering the information from the medicine men. (Table 1).

Table 1. Ailment categories

Ailment categories	Biomedical terms	Gujarati terms
Circulatory system/cardiovascular diseases (CSCD)	Heart pain	Hraday no dukhavo
	Heart strength	Hraday ni shakti
	Blood purification	Lohi ni shudhee
	Memory power	Yad shakti
Dental care (DC)	Mouth heat	Mo ni garmee
	Mouth ulcers	Mo na chanda
	Tooth ache	Dant no dukhavo
	Foul odour	Mo ni durgandh
	Teeth strength	Dant ni shaktee
	Worms in gums & teeth	Mo ma jivat

Dermatological infections/diseases (DID)	Wounds	Gha
	Burns	Dajvu
	Itching	Khanjval
	Skin ulcers	Chamdi ma chanda
	Cuts	Vadhiya
	Pimples	Kheel
	Boils	Gumda
Ear, nose, throat problems (ENT)	Nasal infection	Nak ma chep
	Ear ache	Kan no dukhavo
	Cataracts	Motiyo
	Ophthalmia	Aankh no sojo
Endocrinal disorders (ED)	Diabetes	Madhuprameh
Gastro-intestinal ailments (GIA)	Stomach pain	Pet no dukhavo
	Constipation	Kabajiyat
	Gastric complaints	Vat ni takleef
	Dysentery	Mardo
	Indigestion	Apache
	Intestinal ulcer	Aantarda ma chanda
Fever (Fvr)	Fever	Tav
Genito-urinary ailments (GUA)	Burning during urination	Peshab ma baltra
	Delivery pain	Prasav ni peeda
Hair care (HC)	Dandruff	Khod
	Hair loss	Val kharva
Liver problems (LP)	Jaundice	Kamlo
Respiratory system diseases (RSD)	Cough	Kaf
	Asthma	Dam
Skeleto-muscular system disorders (SMSD)	Head ache	Matha no dukhavo
	Rheumatism	Sandhiva
	Swelling	Soja

Data analysis

Informant consensus factor (F_{ic})

This index was used to determine the agreement in how all the medicine men used the plants to cure ailments. F_{ic} calculation has been performed by formula:¹⁴

$$F_{ic} = N_{ur} - N_t / N_{ur} - 1^{14}$$

Where, " N_{ur} = number of use-reports for an ailment category, N_t = number of species used for an ailment category by all informants".¹⁴ Value of F_{ic} can be obtained between 0 to 1. High value (close to 1.0) means informants used less species for curing a particular ailment. Low value

means informants do not agree about the species that can be used for treating a particular illness of the ailment category.

Use Value (UV)

Plant species which is locally used as medicine and its importance can be calculated by use value (UV). UV calculation has been performed by formula:¹⁵

$$UV = \Sigma U / n^{15}$$

Where, " UV = use value of a species, ΣU = summation of number of use-reports given by informants for a given plant species and n = total number of informants interviewed for a given plant".¹⁵ Index UV is for determining the highest use of a particular plant which indicates most frequently used plants. High UV means there are maximum use-reports for plant, low UV means there are minimum use-reports for plant.

Fidelity level (FL)

It is used to identify the plants which were used most frequently by the medicine men for treating an ailment. FL calculation has been performed by formula:¹⁶

$$FL (\%) = N_p / N \times 100^{16}$$

Where, " N_p = number of use-reports given for a species for a particular ailment category and N = the number of use-reports given for any species".¹⁶ High FL means that all the use-reports showed same way of the way of utilization of plants. Low FL means plant species used for various purposes.¹⁷

RESULTS & DISCUSSION

Documentation of indigenous ethnomedicinal knowledge

This study showed that medicine men of Barda Sanctuary used 51 plant species, distributed in 47 genus and belonging to 31 plant families. These plant species used in maximum amount by Maldharies traditional healers for treating ailments of 39 types. Plant family Fabaceae was found to be most important which had six plant species. We have given botanical name of plants, local (Gujarati) name of the plants, use value, life form, parts of plant used and ailment treated (Table 2).

Life forms and parts used

Trees were found to be the primary source from which medicine men of Barda Sanctuary made medicines (51%) which was followed by herbs (25%) and then shrubs (24%) (Fig. 2). The leaves (28%) among all the other plant parts used, were used most frequently for preparing the

medicines. It was then followed by fruit (25 %), stem bark (20 %), root (16 %), flower (6 %), seed (4 %) and latex (1%). (Fig. 3). Other tribal communities in other parts of the world used leaves for preparing medicines from plants as well.¹⁷⁻²⁵ It can be attributed to a fact that it is quite easy

to collect leaves. This is the reason why leaves are used most frequently in making medicines by tribal people.²⁶ Scientific perspective provides information on leaves participating in the process of photosynthesis and metabolites production.²⁷

Table 2. List of commonly used medicinal plants by Maldharies in Barda Sanctuary

Botanical name (Family)	Local name	Life form	Use value	Parts used	Ailment category: no. of use-repts (ailments treated)
<i>Abrus precatorius</i> L. (Fabaceae)	Chanothi	He	0.89	Lf	ENT: 5 (Cataracts)
<i>Abrus precatorius</i> L. (Fabaceae)	Chanothi	He	0.89	Lf Lf	ENT: 5 (Cataracts) GU: 3 (Stomach pain)
<i>Abutilon indicum</i> (L.) Sweet, Hort. (Malvaceae)	Khapat	Sh	0.78	Sb	DC: 7 (Mouth heat)
<i>Acacia chundra</i> (Roxb. ex Rottl.) Willd. (Fabaceae)	Kher	Tr	0.89	Sb	DC: 8 (Mouth ulcers)
<i>Acacia concinna</i> Sensu auct., non (Willd.) DC. (Fabaceae)	Shikakai	Sh	0.67	Fr	LP: 6 (Jaundice)
<i>Acacia leucophloea</i> (Fabaceae)	Harmo baval	Tr	0.78	Sb	RSD: 7 (Cough)
<i>Acacia sengel</i> (L.) Willd. (Fabaceae)	Gorad	Tr	1.67	Rt	ED: 2 (Diabetes)
				Rt	GUA: 5 (Burning during urination)
				Lf	DID: 3 (Boils)
				Lf	SMSD: 2 (Swelling)
				Lf	LP: 1 (Jaundice)
<i>Achyranthes aspera</i> L. var. <i>aspera</i> (Amaranthaceae)	Anghedi	He	1.89	Lx	RSD: 2 (Cough)
				Sb	DC: 2 (Teeth strength)
				Lf	GUA: 9 (Burning during urination)
<i>Adina cordifolia</i> (Roxb.) Bth. & Hk. f. ex Brandis (Rubiaceae)	Haldarvo	Tr	1.67	Lf	RSD: 6 (Asthma)
				Fl	SMSD: 4 (Head ache)
				Sb	DID: 5 (Boils)
<i>Aegle marmelos</i> (L.) Corr. (Rutaceae)	Bili	Tr	3.00	Fl	RSD: 6 (Cough)
				Fr	ENT: 5 (Ear ache)
				Fr	GIA: 9 (Dysentery)
				Lf	SMSD: 5 (Rheumatism)
				Lf	DID: 6 (Burns)
<i>Alianthus excelsa</i> Roxb. (Simaroubaceae)	Arduso	Tr	1.56	Rt	CSCD: 2 (Heart strength)
				Sb	GIA: 3 (Stomach pain)
				Sb	Fvr: 2 (Fever)
				Sb	RSD: 3 (Cough)
				Sb	DID: 2 (Boils)
<i>Allium sativum</i> L. (Liliaceae)	Lasan	He	0.89	Sb	SMSD: 4 (Rheumatism)
				Lf	Fvr: 8 (Fever)
				Lf	DID: 9 (Burns)
				Lf	DID: 2 (Pimples)
				Sb	GIA: 5 (Dysentery)
<i>Aloe barbadensis</i> Mill. (Liliaceae)	Kuvarpathu	Sh	1.00	Sb	Fvr: 3 (Fever)
				Sb	RSD: 6 (Asthma)
				Fr	ED: 4 (Diabetes)
				Fr	CSCD: 5 (Blood purification)
				Fr	ED: 6 (Diabetes)
<i>Alstonia scholaris</i> (L.) R. Br. (Apocynaceae)	Saptarni	Tr	2.78	Lf	DID: 5 (Skin ulcers)
				Sb	CSCD: 4 (Memory power)
				Sb	Fvr: 3 (Fever)
				Fl	RSD: 6 (Asthma)
				Fr	ED: 4 (Diabetes)
<i>Andrographis paniculata</i> (Burm. F.) Wall. ex Ness (Acanthaceae)	Lilu karyatu	He	0.67	Lf	ED: 6 (Diabetes)
				Lf	ED: 6 (Diabetes)
<i>Argemone mexicana</i> L. (Papaveraceae)	Darudi	He	0.56	Sd	DID: 5 (Skin ulcers)
<i>Buchnanania lanzan</i> Spreng. (Anacardiaceae)	Charodi	Tr	0.44	Sd	CSCD: 4 (Memory power)
<i>Butea monosperma</i> (Lam.) Taub. (Fabaceae)	Khakhro	Tr	1.11	Sb	DC: 2 (Tooth ache)
				Rt	RSD: 3 (Cough)
				Rt	DID: 5 (Boils)

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<i>Carissa congesta</i> Wt. (Apocynaceae)	Karamda	Sh	1.00	Fr	DID: 9 (Itching)
<i>Clerodendrum phlomoides</i> Hort. Ital. ex DC. (Lamiaceae)	Arni	Sh	1.00	Lf	GUA: 9 (Delivery pain)
<i>Coccinia grandis</i> (L.) Voigt. (Cucurbitaceae)	Tindori	He	0.67	Fr	ED: 6 (Diabetes)
<i>Commiphora wightii</i> Arn. Bhandari (Bursaceae)	Gugal	Tr	0.44	Sb	SMSD: 4 (Rheumatism)
<i>Datura metel</i> L. (Solanaceae)	Kalo dhaturu	He	0.44	Sd	SMSD: 4 (Swelling)
<i>Enicostema hyssopifolium</i> (Willd.) Verdoon (Gentianeae)	Mamejvo	He	1.00	Lf	Fvr: 9 (Fever)
<i>Eucalyptus camaldulensis</i> Dehnh. (Myrtaceae)	Nilgiri	Tr	2.44	Lf	ENT: 5 (Nasal infection)
				Sb	RSD: 9 (Cough)
				Sb	SMSD: 8 (Rheumatism)
<i>Garcinia indica</i> (Thouras) Chiosy. (Clusiaceae)	Kokam	Tr	0.78	Fr	DID: 7 (Cuts)
<i>Helicteres isora</i> L. (Sterculiaceae)	Marda shing	Tr	1.67	Fr	GIA: 3 (Dysentery)
				Rt	ED: 5 (Diabetes)
				Rt	Fvr: 7 (Fever)
<i>Jatropha curcas</i> L. (Euphorbiaceae)	Ratanjyot	Sh	0.67	Lf	DC: 6 (Foul odour)
<i>Justicia adhatoda</i> L. (Acanthaceae)	Ardusi	Sh	0.56	Lf	ENT: 5 (Ophthalmia)
<i>Maytenus emarginata</i> (Willd.) Ding. Hou. (Celastraceae)	Vikdo	Sh	3.11	Lf	LP: 7 (Jaundice)
				Sb	DID: 6 (Boils)
				Rt	SMSD: 4 (Head ache)
				Lf	DC: 3 (Tooth ache)
				Lf	Fvr: 6 (Fever)
				Fr	CSCD: 2 (Blood purification)
<i>Mimusops elengi</i> L. (Sapotaceae)	Borsali	Tr	2.22	Sd	GIA: 3 (Intestinal ulcer)
				Rt	SMSD: 7 (Swelling)
				Fl	RSD: 8 (Cough)
				Fl	CSCD: 2 (Heart strength)
<i>Mitragyna parvifolia</i> Roxb. Koth. (Rubiaceae)	Kalam	Tr	2.89	Sb	ED: 2 (Diabetes)
				Rt	SMSD: 7 (Rheumatism)
				Rt	Fvr: 1 (Fever)
				Rt	GIA: 6 (Gastric complaints)
				Fr	DID: 4 (Skin ulcers)
				Fr	CSCD: 1 (Blood purification)
				Fr	RSD: 5 (Cough)
<i>Momordica dioica</i> Roxb. ex Willd. (Cucurbitaceae)	Kantola	He	0.56	Fr	DC: 5 (Mouth heat)
<i>Murraya paniculata</i> (L.) Jack. (Rutaceae)	Kamini	Sh	0.78	Lf	Fvr: 7 (Fever)
<i>Nyctanthes arbortristis</i> L. (Oleaceae)	Parijatak	Sh	0.44	Lf	HC: 4 (Dandruff)
<i>Ocimum basilicum</i> L. (Lamiaceae)	Damro	He	0.89	Lf	ENT: 4 (Ear ache)
				Fl	SMSD: 4 (Head ache)
<i>Oroxylum indicum</i> L. Vent. (Bignoniaceae)	Tetu	Tr	0.89	Fr	CSCD: 8 (Heart strength)
<i>Pergularia daemia</i> (Frosk.) Chiov (Asclepiadaceae)	Chamar dudhli	He	0.78	Lf	DID: 7 (Boils)
<i>Phyllanthus emblica</i> L. (Phyllanthaceae)	Aamla	Tr	2.56	Fr	HC: 9 (Hair loss)
				Rt	SMSD: 2 (Swelling)
				Rt	DID: 6 (Burns)
				Fr	CSCD: 1 (Blood purification)
<i>Pongamia pinnata</i> (L.) Pierre. (Fabaceae)	Karanj	Tr	1.44	Sb	DC: 2 (Tooth ache)
				Rt	DID: 6 (Swelling)
				Sd	SMSD: 5 (Rheumatism)
<i>Pterocarpus marsupium</i> Roxb. var. <i>acuminatus</i> Prain (Fabaceae)	Biyo	Tr	2.33	Sb	DC: 1 (Worms in gum & teeth)
				Sb	ED: 5 (Diabetes)
				Lf	DID: 7 (Cuts)
				Lf	RSD: 6 (Cough)
				Lf	CSCD: 2 (Blood purification)

<i>Sapindus laurifolius</i> Vahl (Sapindaceae)	Aritha	Tr	1.56	Fr	HC: 9 (Dandruff)
				Lf	DID: 1 (Boils)
				Fr	SMSD: 3 (Head ache)
				Fr	GUA: 1 (Delivery pain)
<i>Senna italica</i> Mill. (Fabaceae)	Mindhi aaval	Tr	0.67	Fr	GIA: 6 (Gastric complaints)
<i>Syzygium cumini</i> (L.) Skeels (Myrtaceae)	Jambudo	Tr	0.56	Fr	ED: 5 (Diabetes)
<i>Tamarindus indica</i> L. (Fabaceae)	Aamli	Tr	1.00	Fr	GIA: 9 (Constipation)
<i>Terminalia arjuna</i> (Roxb.) W. & A. (Combretaceae)	Arjun Sadad	Tr	0.89	Sb	CSCD: 8(Heart pain)
<i>Terminalia chebula</i> Retz. (Combretaceae)	Harde	Tr	1.00	Fr	GIA: 9 (Indigestion)
<i>Trachyspermum ammi</i> (L.) Sprague (Apiaceae)	Ajmo	He	0.89	Fr	Fvr: 8 (Fever)
<i>Typha angustata</i> Bory & Chaub. (Typhaceae)	Ghabajariyu	He	1.00	Lf	DID: 9 (Wounds)
<i>Withania somnifera</i> (L.) Dunal (Solanaceae)	Ashwgandha	Sh	0.89	Rt	CSCD: 8 (Blood purification)
<i>Wrightia tinctoria</i> R. Br. (Apocynaceae)	Dudhlo	Tr	1.11	Lf	DID: 4 (Boils)
				Rt	SMSD: 6 (Rheumatism)
<i>Zizyphus nummularia</i> (Burm. F.) Wight. & Arn. (Rhamnaceae)	Chani bor	Sh	0.67	Fr	CSCD: 6 (Heart pain)

Parts used: Lf – Leaf, Sb – Stem bark, Fr – Fruit, Sd – Seed, Lx – Latex, Fl – Flower, Rt – Root

Life forms: He – Herb, Sh – Shrub, Tr – Tree

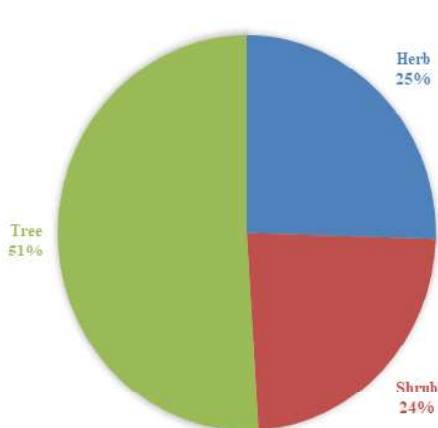


Figure 2. Life forms percentage used by Maldhari medicine men

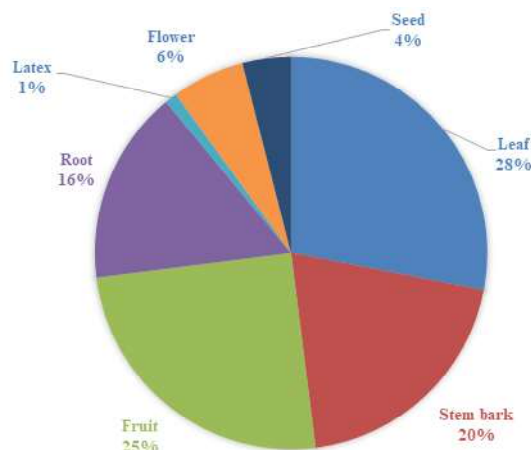


Figure 3. Plant parts percentage used by Maldhari medicine men

Plant use values

Plant species used most was *Maytenus emarginata* having 28 use-reports given by 9 informants, which gave the highest use value of 3.11. *Maytenus emarginata* was used in treating many ailments and it was recognised by every traditional healer as a plant species for treatment of jaundice.

Other most important species of plants having high use values were *Aegle marmelos* (27 use-reports, 9 informants, UV 3.00), *Mitragyna parvifolia* (26 use-reports, 9 informants, UV = 2.89), *Alstonia scholaris* (25 use-reports, 9 informants, UV = 2.78), *Phyllanthus emblica* (23 use-reports, 9 informants, UV = 2.56), *Eucalyptus camaldulensis* (22 use-reports, 9 informants, UV = 2.44), *Pterocarpus marsupium* (21 use-reports, 9 informants, UV = 2.33) and *Mimusops elengi* (20 use-reports, 9 informants, UV = 2.22).

The plant with very low use values was *Nyctanthes arbortristis* with a UV of 0.44. If the plant species is scarcely available in any particular area, it can then lead to low UV.²⁸ In this study, plants reported with a low use value (below 1.00) were *Abrus precatorius*, *Acacia chundra*, *Allium sativum*, *Ocimum basilicum*, *Oroxylum indicum*, *Terminalia arjuna*, *Trachyspermum ammi*, *Withania somnifera* (8 use-reports by 9 informants with a UV of 0.89), *Abutilon indicum*, *Acacia leucophloea*, *Garcinia indica*, *Murraya paniculata*, *Pergularia daemia* (7 use-reports by 9 informants with a UV of 0.78), *Acacia concinna*, *Andrographis paniculata*, *Coccinia grandis*, *Jatropha curcas*, *Senna italica*, *Zizyphus nummularia* (6 use-reports by 9 informants with a UV of 0.67), *Argemone mexicana*, *Justicia adhatoda*, *Momordica dioica*, *Syzygium cumini* (5 use-reports by 9 informants with a UV of 0.56).

Informant consensus factor

Informant consensus factor (F_{ic}) results depends on how the medicine men of the study are treat a particular ailment and also whether particular plant is available in the study area or not.²⁹ We classified illness into ailment categories for using index informant consensus factor (F_{ic}). In our study area the (F_{ic}) values ranged from 0.77 to 0.90. 103 use-reports in dermatological infections/diseases (cured by 19 plant species). 69 use-reports in skeletal-muscular system disorders (cured by 15 plant species), 61

use-reports in respiratory system diseases (cured by 11 species), 58 use-reports in gastro-intestinal ailments (cured by 10 plant species), 51 use-reports in fever (cured by 9 species) (Fig. 4). F_{ic} value of 0.90 which is the highest value, was obtained in the treatment of hair care. F_{ic} value 0.77 which is the lowest value, was obtained in circulatory system/cardiovascular system disorders with the lowest F_{ic} of 0.77. For treating ailments of infections/diseases 19 plant species were used (Table 3).

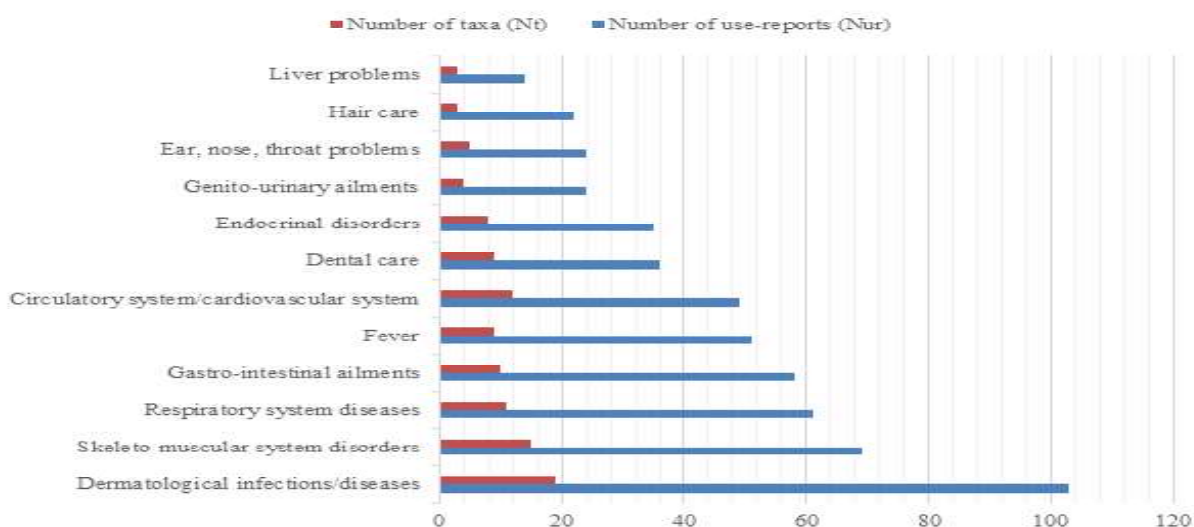


Figure 4. Ailment categories arranged by number of use-reports

Table 3. Informant consensus factor for commonly used medicinal plants

Ailment category	Number of use-reports (N_{ur})	Number of species (N_i)	Informant Consensus Factor (F_{ic})
Circulatory system/cardiovascular system disorders	49	12	0.77
Dental care	36	9	0.77
Dermatological infections/diseases	103	19	0.82
Ear, nose, throat problems	24	5	0.82
Endocrinal disorders	35	8	0.79
Fever	51	9	0.84
Gastro-intestinal ailments	58	10	0.84
Genito-urinary ailments	24	4	0.86
Hair care	22	3	0.90
Liver problems	14	3	0.84
Respiratory system diseases	61	11	0.83
Skeleto-muscular system disorders	69	15	0.79
Total	546	108*	

* a species may be reported in more than one ailment category

Fidelity level

This index identifies most important plants in each ailment category (Table 4). Many informants used 32 species in the treatment of single ailment category and these plant species had 100% (highest) fidelity level. These plant species are *Buchnanian lanzan*, *Oroxylum indicum*, *Terminalia arjuna*, *Zizyphus nummularia*, *Withania somnifera* (CSCD), *Abutilon indicum*, *Momordica dioica*, *Acacia chundra*, *Jatropha curcas* (DC), *Aloe barbadensis*, *Argemone mexicana*, *Carissa congesta*, *Garcinia indica*, *Pergularia daemia*, *Typha angustata* (DID), *Justicia adhatoda* (ENT), *Andrographis paniculata*, *Coccinia*

grandis, *Syzygium cumini* (ED), *Allium sativum*, *Encostema hyssopifolium*, *Murraya paniculata*, *Trachyspermum ammi* (Fvr), *Senna italica*, *Tamarindus indica*, *Terminalia chebula* (GIA), *Clerodendrum phlomoides* (GUA), *Nyctanthes arbortristis* (HC), *Acacia concinna* (LP), *Acacia leucophloea* (RSD), *Commiphora wightii*, *Datura metel* (SMSD).

The maximum FL of 100% of these plants showed choices of the interviewed traditional healers who made medicines from plants for the treatment specific ailments. This may have been an indication that they have huge healing potential.¹⁸

Table 4. Fidelity level (FL) values for common medicinal plants used by Maldhari medicine men by ailment category

Ailment categories	Most preferred species with specific ailments	FL (%)
Circulatory system/cardiovascular system diseases	<i>Buchnanian lanzan</i> (Memory power)	100.00
	<i>Oroxylum indicum</i> (Heart strength)	100.00
	<i>Terminalia arjuna</i> , <i>Zizyphus nummularia</i> (Heart pain)	100.00
	<i>Withania somnifera</i> (Blood purification)	100.00
Dental care	<i>Abutilon indicum</i> , <i>Momordica dioica</i> (Mouth heat)	100.00
	<i>Acacia chundra</i> (Mouth ulcers)	100.00
	<i>Jatropha curcas</i> (Foul odour)	100.00
Dermatological infections/diseases	<i>Aloe barbadensis</i> (Burns)	100.00
	<i>Argemone mexicana</i> (Skin ulcers)	100.00
	<i>Carissa congesta</i> (Itching)	100.00
	<i>Garcinia indica</i> (Cuts)	100.00
	<i>Pergularia daemia</i> (Boils)	100.00
	<i>Typha angustata</i> (Wounds)	100.00
Ear, nose, throat problems	<i>Justicia adhatoda</i> (Ophthalmia)	100.00
Endocrinal disorders	<i>Andrographis paniculata</i> , <i>Coccinia grandis</i> , <i>Syzygium cumini</i> (Diabetes)	100.00
Fever	<i>Allium sativum</i> , <i>Encostema hyssopifolium</i> , <i>Murraya paniculata</i> , <i>Trachyspermum ammi</i> (Fever)	100.00
Gastro-intestinal ailments	<i>Senna italica</i> (Gastric complaints)	100.00
	<i>Tamarindus indica</i> (Constipation)	100.00
	<i>Terminalia chebula</i> (Indigestion)	100.00
Genito-urinary ailments	<i>Clerodendrum phlomoides</i> (Delivery pain)	100.00
Hair care	<i>Nyctanthes arbortristis</i> (Dandruff)	100.00
Liver problems	<i>Acacia concinna</i> (Jaundice)	100.00
Respiratory system diseases	<i>Acacia leucophloea</i> (Cough)	100.00
Skeleto-muscular system disorders	<i>Commiphora wightii</i> (Rheumatism)	100.00
	<i>Datura metel</i> (Swelling)	100.00

CONCLUSION

This study showed that Maldhaires were still using ethnomedicines. Only a few people of the study area had ethnomedicinal knowledge. Therefore, it is required to collect this knowledge possessed by Maldhaires. By doing so, our investigation will help to prevent this knowledge from getting lost of the Maldhari nomads. Ethnomedicinal plants which showed highest fidelity level and highest use values in investigation, might possibly be indicating

important phytochemicals, therefore these plant species require a thorough research for having the potential of new drugs for treating of many ailments.

These ethnomedicinal plants which showed high values of indices should be evaluated for further phytochemical and pharmacological studies for checking their efficacy. As a result of this study, we suggest these plants *Maytenus emarginata*, *Aegle marmelos*, *Mitragyna parvifolia*, *Alstonia scholaris*, *Phyllanthus emblica*, *Eucalyptus camaldulensis*, *Pterocarpus marsupium* and

Mimusops elengi for further studying the ethno pharmacological properties, because these plant species had the high use values. Plants *Zizyphus nummularia*, *Acacia chundra*, *Carissa congesta*, *Syzygium cumini* and *Tamarindus indica* with highest fidelity level of 100% for particular ailment category could be analysed further in the studies of pharmacology.

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REFERENCES

1. **Calixto J. B. 2005.** Twenty-five years of research on medicinal plants in Latin America: a personal review. *Journal of Ethnopharmacology*. **100(1-2)**:131-134. DOI: 10.1016/j.jep.2005.06.004
2. **Heinrich M. 2000.** Ethnobotany and its role in drug development. *Phytotherapy Research*. **14(7)**:478-488. DOI: 10.1002/1099-1573(200011)14:7<479:aid-ptr958>3.0.co;2-2
3. **Hoareau L., DaSilva E. J. 1999.** Medicinal plants: a re-emerging health aid. *Electric Journal of Biotechnology*. **2(2)**:56-70. DOI: 10.4067/S0717-34581999000200002
4. **Iwu M. W., Duncan A. R., Okunji C. O. 1999.** New antimicrobials of plant origin. In: Janick, J. (Ed.), Perspectives on New Crops and New Uses, ASHS Press, Alexandria, VA, pp. 457-462.
5. **Ernst E. 2005.** The efficacy of herbal medicine – an overview. *Fundamental and Clinical Pharmacology*. **19(4)**: 405-409. DOI:10.1111/j.1472-8206.2005.00335.x
6. **Rates S. M. K. 2001.** Plants as source of drugs. *Toxicon*. **39(5)**:603-613. DOI: 10.1016/s0041-0101(00)00154-9
7. **Kosalge S. B., Fursule R. A. 2008.** Investigation of ethnomedicinal claims of some plants used by tribals of Satpuda Hills in India. *Journal of Ethno pharmacology*. **121(3)**:456-461. DOI: 10.1016/j.jep.2008.11.017
8. **Namsa N. D., Tag H., Mandal M., Kalita P., Das A. K. 2009.** An ethnobotanical study of traditional anti-inflammatory used by the Lohit community of Arunachal Pradesh, India. *Journal of Ethno pharmacology*. **125(2)**:234-245. DOI: 10.1016/j.jep.2009.07.004
9. **Pattanaik C., Reddy C. S., Murthy M. S. 2008.** An ethnobotanical survey of medicinal plants used by the Didayi tribe of Malkangiri district of Orissa, India, *Fitoterapia*. **79(1)**: 67-71. DOI: 10.1016/j.fitote.2007.07.015
10. **Savithamma N., Sulochna C., Rao K. N. 2007.** Ethnobotanical survey of plants used to treat asthma in Andhra Pradesh, India. *Journal of Ethnopharmacology*. **113(1)**: 54-61. DOI: 10.1016/j.jep.2007.04.004
11. **Upadhyay B., Parveen, Dhaker A. K., Kumar A. 2010.** Ethnomedicinal and ethnopharmaco-statistical studies of Eastern Rajasthan, India. *Journal of Ethnopharmacology*. **129(1)**: 64-86. DOI: 10.1016/j.jep.2010.02.026
12. **Jadeja B. A. 1999.** Plants used by the tribal Rabari of Barda Hills of Gujarat, *Ethnobotany*. **11(1-2)**:42-46.
13. **Nurani M. A. A. G. 1996.** Epidermal Phytosociological and Ethno Botanic study of some Angiosperms of Barda Hills, Ph.D. Thesis, Bhavnagar University, Bhavnagar, Gujarat, India.
14. **Heinrich M., Ankil A., Frei B., Weimann C., Sticher O. 1998.** Medicinal plants in Mexico: healers' consensus and cultural importance. *Social Science and Medicine*. **47(11)**: 91-112. DOI: 10.1016/s0277-9536(98)00181-6
15. **Phillips O., Gentry A. H., Reynel C., Wilkin P., Galve-Durand B. C. 1994.** Quantitative ethnobotany and Amazonian conservation. *Conservation Biology*. **8(1)**:225-248. URL: <https://www.jstor.org/stable/2386737>
16. **Friedmen J., Yaniv Z., Dafin A., Palewitch D. 1986.** A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev desert, Israel. *Journal of Ethno pharmacology*. **16(2-3)**: 275-287. DOI: 10.1016/0378-8741(86)90094-2

17. **Srithi K., Balslev H., Wangpakapattanawong P., Srisanga P., Trisonthi C. 2009.** Medicinal plant knowledge and its erosion among Mien (Yao) in northern Thailand, *Journal of Ethnopharmacology*. **123(2)**:335-342. DOI: 10.1016/j.jep.2009.02.035
18. **Ayyanar M., Ignacimuthu S. 2011.** Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India. *Journal of Ethnopharmacology*. **134(3)**:851-864. DOI: 10.1016/j.jep.2011.01.029
19. **Cakilcigolu U., Turkoglu I. 2010.** An ethnobotanical survey of medicinal plants in Sivrice (Elazig-Turkey). *Journal of Ethnopharmacology*. **132(1)**: 165-175. DOI: 10.1016/j.jep.2010.08.017
20. **Giday M., Asfaw Z., Woldu Z. 2010.** Ethnomedicinal study of plants used by Sheko ethnic group of Ethiopia. *Journal of Ethnopharmacology*. **132(1)**: 75-78. DOI: 10.1016/j.jep.2010.07.046
21. **Gonzalez J. A., Garcia-Barriuso, M., Amich, F. 2010.** Ethnobotanical study of medicinal plants traditionally used in the Arribes del Duero, Western Spain. *Journal of Ethnopharmacology*. **131(2)**:343-355. DOI: 10.1016/j.jep.2010.07.022
22. **Ignacimuthu S., Ayyanar M., Sankarasivaraman K. 2006.** Ethnobotanical investigation among tribes in Madurai district of Tamil Nadu, India. *Journal of Ethnobiology and Ethnomedicine*. **11(2)**:25. DOI: 10.1186/1746-4269-2-25
23. **Ignacimuthu S., Ayyanar M., Sankarasivaraman K. 2008.** Ethno-botanical study of medicinal plants used by Paliyar tribals in Theni district of Tamil Nadu, India. *Fitoterapia*. **79(7-8)**: 562-568. DOI: 10.1016/j.fitote.2008.06.003
24. **Mahishi P., Srinivas B. H., Shivanna M. B. 2005.** Medicinal plants wealth of local communities in some villages in Shimoga District of Karnataka, India. *Journal of Ethnopharmacology*. **98(3)**: 307-312. DOI: 10.1016/j.jep.2005.01.035
25. **Teklehaymanot T., Giday M., Medhin G., Mekonnen Y. 2007.** Knowledge and use of medicinal plants by people around Debre Libanos monastery in Ethiopia. *Journal of Ethnopharmacology*. **111(2)**: 271-283. DOI: 10.1016/j.jep.2006.11.019
26. **Giday M., Asfaw Z., Woldu Z. 2009.** Medicinal plants of the Meinit ethnic group of Ethiopia: an ethnobotanical study. *Journal of Ethnopharmacology*. **124(3)**: 513-521. DOI: 10.1016/j.jep.2009.05.009
27. **Ghorbani A. 2005.** Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran (Part 1): general results. *Journal of Ethnopharmacology*. **102(1)**: 58-68. DOI: 10.1016/j.jep.2005.05.035
28. **Rokaya M. B., Munzbergova Z., Timsina B. 2010.** Ethnobotanical study of medicinal plants from the Humla district of western Nepal. *Journal of Ethnopharmacology*. **130(3)**: 485-504. DOI: 10.1016/j.jep.2010.05.036
29. **Rajakumar N., Shivanna M. B. 2009.** Ethnomedicinal application of plants in the eastern region of Shimoga District, Karnataka, India. *Journal of Ethnopharmacology*. **126(1)**: 64-73. DOI: 10.1016/j.jep.2009.08.010
