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PREVALENCE OF TRADITIONAL MEDICATIONS THROUGH NATIVE FLORAL ELEMENTS AMONG TRIBAL COMMUNITIES OF KACHCHH ARID ECOSYSTEM, GUJARAT, INDIA

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Abstract

This communication deals with the documentation of 38 medicinal plant species used for indigenous medications by local villagers such as pastoralists (*Maldharis*) and farmers of Tapkeshwari Hill Range (THR), Bhuj Taluka, Kachchh District, Gujarat, India. Traditional knowledge on medicinally important plant species has been recorded from tribal communities through semi-questionnaire survey using an open-ended questionnaire datasheets. The response from the people interviewed clearly indicated that most of the villagers were fully or partially dependent on the forest produce for their primary healthcare requirements as well as for curing chronic or acute disorders and ailments. Plant parts such as bark, flowers, fruits, gum, latex, leaves, roots, seeds, and spadix, were found to be used for the cure of bronchitis, cold, cough, diabetes, diarrhea, dropsy, dysentery, earache, fever, fistula, gastric troubles, hypothermia, indigestion, piles, skin diseases, snake-bites, toothache, and ulcer. The most predominantly used 10 plant species in the area are *Asparagus racemosus, Balanites aegyptiaca, Capparis cartilaginea, Cassia auriculata, Commiphora wightii, Enicostema axillare, Fagonia schweienfurthii, Maytenus emerginata, Tinospora cordifolia,* and *Tribulus terrestris.* An enumeration of these 38 medicinal plant species is presented; each species is cited with correct scientific names, vernacular names, ailments treated for, mode of preparation and dosages.

Keywords**:** *Medicinal Plants, Indigenous medications, Tribal communities, Tapkeshwari Hill Range, Gujarat, India*

Introduction

It is a well-known fact that many wild food plants are used by tribal communities for medicinal purposes in curing various ailments. The medicinal properties of wild edible plants contribute significantly to the better health of humans worldwide. Many wild plants are

a good source of vitamins and minerals for better body growth of children, when cultivated fruits and vegetables are not easily available **(Tardio*et al.*, 2006).** The utilization of plants as medicines is an ancient and global tradition that represents the cornerstone of healthcare for many rural communities in developing countries **(Robbins, 2000). Okello and Segawa (2007)** stated that the estimated number of human beings using medicinal plants is now increasing world over in both developed and developing countries. Today, many medicinal plants are facing threats of extinction and loss of their genetic diversities. It has been argued that plant knowledge and intensity of plant use are being diminished with increasing distance from human settlements. It is also known that tribal communities living in arid environments (e.g. deserts, semi-arid ecosystems, savannas, grasslands, steppes, and dry forests) have developed numerous strategies of natural resource use. Among them, the popular strategy is utilization of different environments and ethno-ecological units defined in accordance with altitudinal gradients, either near or far from residential settings. Particularly at the edge of different ecological zones, people maximize the use of faunal and floral elements from which they can draw for their livelihoods **(Thomas *et al.*, 2009).**

Plant species and traditional knowledge on the therapeutic uses of plants are important for adequate utilization of herbal plant resources. The vegetation cover and forest resources of India offer enormous variety of flora with a wide range of medicinal plants. The process of documentation of medicinal plants in India is almost as old as our knowledge. Gujarat with its rich floral diversity in various forested patches and non-forest areas hold rich natural wealth of medicinal plants. The presence of a sizeable strength of *Ayurvedic* pharmaceuticals and popularity of wide range of traditional ethno-botanical practices reveal the evidence of the rich medicinal flora of Gujarat especially in the tribal belts **(Pandey *et al.*, 2005).**

To date, the existing information on medicinal plants of Kachchh District, Gujarat State, India, is limited (not in terms of taxonomic studies), but with context of their ecological status and their uses by tribal communities **(Joshi *et al*., 2012)**. The complete inventory of medicinal plants, which is the first requisite for any conservation planning of threatened medicinal species, is scanty **(Silori and Rana, 2000)**. Kachchh, being a semi-arid ecosystem, supports many plant species of high medicinal values of several plant species such as *Boerhavia diffusa*, *Capparis cartilaginea*, *Commiphora wightii* and *Tribulus terrestris* are being exploited tremendously for commercial as well as medicinal purposes, which resulted in the sharp decline in its population in recent past. However, most of the knowledge on medicinal properties of such species has never been compiled in written form, but being

transferred verbally from one generation to next generation **(Joshi, 2002; GUIDE, 2002, 2009; Joshi *et al*., 2007).** Of the total 448 plant species recorded from THR, tribal people were found to consume 209 medicinally important plant species, of which 38 species were commonly used by all the villagers to cure common diseases. Hence, it is very much critical to compile and document the traditional knowledge of medicinally impotent forest plant species for their long term existence and wider uses by the local people **(Kumar *et al*., 2004; Kumar *et al*., 2005a, 2005b)**.

As far as the ethnobotanical records of Kachchh are concerned, the most important work was done during the last century by **Thakar (1926)** in a Gujarati *'Kachchh Sansthanni Vansptio ane Teni Upyogita'* (Plants of Kachchh and their Utilities). In the following years, the attempts to document the indigenous knowledge of medicinal plants in Kachchh District as well as Tapkeshwari Hill Range (THR) have not been done yet adequately **(Joshi *et al*., 2005)**. In purview of the above information, the aim of the present work was to collect and identify the medicinally important plant species of THR, and their uses by the resident tribal communities.

Materials and Methods

Study Area

For the present study, Tapkeshwari Hill Range (THR) was selected and surveyed from 2010 to 2012, which covers about 140 km^2 (14,400 ha), covering nine villages of two Talukas (Bhuj and Mundra) **(Fig. 1)**. THR is the largest hilly tract of Kachchh, vast area of which falls under the forested land. It is a hilly tract located about seven kilometers near Bhuj, harbours high diversity of floral elements dispersed into different vegetation types (*Euphorbia* Scrub, *Prosopis S*crub, Thorn Mixed Scrub, Open Scrub, Thorn Mixed Forest, *Acacia senegal* Forest, *A. nilotica* Forest and *Salvadora* Mixed Forest). Considering the high floral diversity and unique vegetation assemblage range, it has been suggested that the hilly forested tracts of THR alongwith the adjacent sites should be declared as Ecologically Sensitive Areas (ESA) **(Joshi, 2002).**

THR experiences extreme weather condition including three diverse seasons (Winter, Summer and Monsoon). Winter begins usually from November to February with January being the coldest month, with an average temperature of 10^0C. The period from March to June is exhibited by an intense Summer with the mean temperature between 34^0C to 38.7^0C. The onset of Monsoon is prevailed between the months of July and September. The average annual precipitation of the area is 394.7 mm (2007 to 2009), with an average rainfall in 16.2

rainy days. Winds are generally moderate to high with a mean speed of 12.1 km per hour. Due to high temperature and moderate wind speed, the evapo-transpiration rate is very high (about 18.8 cm of water evaporates annually). Therefore, the average humidity varied between 63 (in early morning) to 36 (in late evening) **(IMD, 2010)**.

Methodology

Interviewing Tribal Communities

Traditional knowledge on medicinal plants was collected from tribal people such as pastoralists (*Maldharis*) and farmers residing in and around THR through semi-structured questionnaires using an open-ended questionnaire datasheets **(Poffenberger *et al*., 1992)**. The study involved use of key informants as well as local people. The questionnaire survey and focus group discussion was aimed to gather the information on past and present status of medicinal plants and their traditional uses to cure different ailments. The purpose of questionnaire survey was to understand the perception of native tribes about uses of medicinal plants to evaluate the medicinal plant resource dependency and its availability. Key informant interviews and participatory observations were employed involving laymen, local people, village heads, forest-dwelling tribes, and *Vaidyas* and H*akims*, for the present investigation **(Gadgil *et al*., 1985; Gadgil, 1994)**. A documentation of ethno-medicinal and economic importance of a particular plant species was done using information on indigenous or traditional knowledge from informants and participants. The information was mainly focused on the use of a particular plant species as a traditional medicine, and its cultural, ecological and ethological association with local people and its surrounding environs (**Gadgil and Vatrak, 1976**). The data collection was prioritized by on-site collection of a plant from the field, conformed to herbaria species, and preparation of database of ethno-medicinal plants used by the local tribes. The entire methodology was adopted using standard published literature **(Jain, 1989; Jain, 1996; Jainand Mudgal, 1999)**.

Plant Identification

The unidentified plant species were brought to the herbarium for an appropriate identification using published literature, monographs and herbarium specimens **(Thaker, 1926; Sutaria, 1962; Shah, 1978)**. In addition, some published information on medicinal plants in local, state and national newspapers, in vernacular language (*Gujarati*) was also referred for confirmation of the species. Later, all the plant species were further confirmed using Traditional Knowledge Digital Library **(TKDL, 2010)**.

Results and discussion

Respondents

The study involved both key informants and tribal people residing in and around THR. In total, 383 villagers were interviewed from 7 villages and 2 hamlets (locally called *Wandh*). Of which, 202 (52.74%) and 76 (19.84%) were pastoralists (*Maldharis*) and farmers, respectively, while rests of the respondents (105 individuals, 27.42%) were either pastoralists (*Maldharis*) or agriculture laborers **(Table 1).**

Table - 1. Details of Respondents of THR involved in Questionnaire Survey

Village	No. of Respondents			
	Pastoralists	**Farmers**	**Others**	**Total**
Jadura	30	12	10	52
Bharapar	38	10	15	63
Sanatorium	10	13	24	47
Sedata	22	14	10	46
Haripar	47	12	9	68
Haripar Wandh	13	0	0	13
Sukhpar Wandh	10	0	0	10
Mirzapar	9	15	25	49
Tapkeshwari	23	0	12	35
Total	**202**	**76**	**105**	**383**
Relative %	**52.74%**	**19.84%**	**27.42%**	**100%**

Plant Species (Life Forms)

The results of questionnaire survey depict that tribal people of THR use 209 plant species to cure different ailments. Of which, 38 (18.19%) plants were found being used frequently by almost all respondents. Local people of Haripar Wandh village used the minimum number (30) of plant species, while tribal people of Haripar village (Table 2) used maximum species (93**)**. The similar trend of use of medicinal plants by tribal people was observed by **Rekha and Vatrak (1975)** in Karnala Bird Sanctuary, Maharashtra State.

Table - 2. Number of Medicinal Plants used by Tribal People of THR

Village	Number of Plants Used					
	Herb	**Shrubs/ Under-shrubs**	**Climbers/ Twiners**	**Grasses**	**Trees**	**Total (Relative %)**

Jadura	45	11	9	12	10	76 (36.36%)
Bharapar	42	9	7	10	7	75 (35.88%)
Sanatorium	34	12	3	9	9	67 (32.06%)
Sedata	28	17	8	16	11	80 (38.27%)
Haripar	56	13	6	11	7	93 (44.49%)
Haripar Wandh	14	8	3	2	3	30 (14.35%)
Sukhpar Wandh	21	7	4	0	6	38 (18.18%)
Mirzapar	12	14	5	8	4	43 (20.57%)
Tapkeshwari	23	11	3	9	4	50 (23.93%)
Total	**94**	**45**	**20**	**28**	**22**	**209**

In total, 448 plants were recorded from THR. Of Which, 209 (46.65%) plant species were medicinally important species, belongs to 50 families (63.29%) and 148 genera (54.22%). Among them, 172 species (45.63%) were dicots and 37 were monocots (52.12%). Among the life forms, herbs were the most dominant plant form in study area (THR), represented by 94 species (44.98%), followed by shrubs and under-shrubs (45, 21.53%), grasses (28, 13.40%), trees (22, 10.53%), and climbers and twiners (20, 9.57%). The dominance of herbs in THR could be due to prolific growth of understory vegetation **Vartak (1959) (Table 2)**.

Ethno-Medicinal Plants

The tribal people of THR were found to use 209 species to cure various diseases or ailments such as bronchitis, cold, cough, diabetes, diarrhea, dropsy, dysentery, earache, fever, fistula, gastric troubles, hypothermia, indigestion, piles, skin diseases, snakebites, toothache, and ulcers. Of the recorded plants, 38 plant species were found to be commonly used by almost all people. It can be inferred from these facts that the unconventional leafy vegetables may provide the vital source of minerals for maintaining the overall health of local people **(Shingade and Chavan, 1996)**. **Table 3** shows the traditional uses of (prioritized) 38 medicinal plants. Based on the feedbacks of respondents and field survey, 10 plant species were found to be the most predominantly used by tribal communities of THR, which are *Asparagus racemosus* var. *javanicus* (Avar Kanto, Satvari), *Balanites aegyptiaca* (Hingor, Ingor), *Capparis cartilaginea* (Parvati Rai, Parvatai), *Cassia auriculata* (Avar), *Commiphora wightii* (Kharo Gugar, Gugal), *Enicostema axillare* (Mamejevo, Mamecho), *Fagonia*

schweienfurthii (Zavansi, Dhamaso), *Maytenus emarginata* (Vikro, Viko), *Tinospora cordifolia* (Gaduvel, Garo, Kad Vel, Kavari), and *Tribulus terrestris* (Pat Gokharu, Akonthi).

Table -3. Enumeration of Medicinal Taxa used for Indigenous Medications by Tribal Communities of THR

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
1. *Abutilon indicum L.* *Family: Malvaceae* *Parts used: Stem, Bark Leaves*	• Leaf paste used to cure ulcers and used as topological applicants on swelling. • Leaf paste used on overhead to cure headache. • Boiling water of young leaves used to cure diabetes. • Leaf paste with cow milk used to cure toothache. • Entire plant sap with milk and sugar used to cure hyper urea. • Leaves paste along with rice powder used to cure piles.	• 50 gm of leaves with equal amount of water at regular interval (3-4 times/day for 7 days) • 10 to 20 gram of leaves paste with equal amount of $CaCO_3$. • 5 gm of dry powder with dry coriander fruits (8-9) to be taken at early morning for 7 days. • Apply on tooth 7-8 times per day for 3-4 days at regular interval. • 20 ml with equal amount of milk and sugar given for 7 days after lunch. • Leaves are ground and mixed with rice powder and given orally thrice in a day to cure piles.
2. *Achyranthes aspera L.* *Family: Amaranthaceae* *Parts used: Leaves, Stem, Seeds*	• Plant ash boiled with water used to cure asthma. • Plant ash mixed with milk and sugar used to cure diabetes. • Ripe seeds powder used to cure cough. • Root used to cure earache. • Leaves used to cure piles.	• Boil 5-10 gm of dry ash powder in 100 ml of water, to be taken spoonful thrice in a day • Mix 10 gm of plant ash with equal quantity of sugar and milk, to be taken after meal for 7 days. • Powder along with honey to be taken after meals. • About 2-3 gm of root powder with oil filtration, and applied twice a day. • 10 leaves crushed with 5 seeds of *Piper nigrum* (Piper) and make pills from paste. • One pill is taken with water for 4 days.

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
3. *Asparagus racemosus var. javanicus* *Family: Liliaceae* *Parts used: Roots, Leaves*	• Crushed roots used to cure any kind of swelling. • Roots used to cure urinary disorders, discharges of blood in urine. • To treat headache due to sunstroke.	• Crush 100-150 gm of roots in small amount of water, paste is applied on swelling for 3 days. • Prepare decoction of roots (5-6 ml only), and consumed twice a day after meals. • Make 50 gm of root paste in water, and applied externally (3-4 times/day).
4. *Balanites aegyptiaca (L.) Del.* *Family: Balanitaceae* *Parts used: Fruit, Pulp*	• Fruit pulp taken once in a day for a month to cure tuberculosis.	• 10-20 gm of fresh fruit pulp with *Ocimum sanctum* (Basil) powder to be taken once a day for a month.
5. *Bauhinia racemosa Lam.* *Family: Caesalpiniaceae* *Parts used: Roots*	• Equal quantity of flowers and of stem of *Cuscuta reflexa* are dried, powdered, and made into tablets (1 gm each) with coconut water. • One tablet twice a day is given to women to ease labor pain.	• 2 to 4 gm of root powder mixed with 5 gm powder of *Terminalia chebula* is taken orally once in a day to check loss of weight during diabetes.
6. *Boerhavia diffusa L.* *Family: Nyctaginaceae* *Parts used: Whole Plant*	• Root paste used to cure boils. • Roots used to reduce body pain. • Plants boiled with water used to get relief from joint pains and rheumatism.	• Crush roots with small quantity of water, and apply paste on boils twice a day for 2 to 3 days. • Mix a tablespoon of powder of dried roots with a glass of cow's milk. Take orally twice a day. • Water is boiled with few plants, used for bathing and drinking by patients suffering from joint pains and rheumatism.
7. *Calotropis procera (Ait.) R. Br.* *Family: Asclepiadaceae* *Parts used: Stem, Leaves*	• Paste used to cure leucoderma. • Powder used to cure dysentery. • Latex used to cure skin disorders.	• Crush roots and flowers in small amount of water, prepare paste, and apply on affected parts of skin. • Make powder of dried leaves and flowers. Take a table spoon of powder (5 gm) with a cup of water twice a day for a week.

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
		• Apply latex on wounds, boils and scorpion bites twice or thrice a day. • Latex is filled in teeth cavity with the help of cotton plug to cure toothache.
8. *Cardiospermum halicacabum L. Family: Sapindaceae Parts used: Entire Plant, Leaves*	• Plant paste used to cure swelling. • Leaf juice used to cure earache.	• Crush entire plant with cow milk to make paste, and apply on swelling thrice a day. • Put 1-3 drops of leaf juice in ear thrice a day for 4-5 days.
9. *Capparis cartilaginea Family: Capparadaceae Parts used: Plant Sap, Flowers, Flower Buds*	• Sap of plant used to cure ulcer, earache and gastric troubles. • Petals of flowers or flower buds used to cure toothache.	• 20 ml decoction of plant parts is taken orally twice a day for two days. • Crush petals of flower or entire flower or flower buds in small quantity of water to make paste, apply paste on tooth for 15 minutes thrice a day after meal.
10. *Capparis decidua (Forsk.) Edgew Family: Capparaceae Parts used: Fruits, Roots*	• Fruits used to cure gastric trouble. • Roots and bark used to cure cough and cold. • Extract of root used to get relief in dropsy.	• Pickles made up of fruits are eaten regularly to cure gastric troubles. • One tablespoon of equal amount of bark powder and honey is taken twice a day for two to three days. • Two teaspoonfuls of extract of roots along with equal quantity of honey is given thrice a day.
11. *Cassia auriculata L. Family: Caesalpiniaceae Parts used: Leaves*	• Leaves used as tannins, well-crushed and applied on head in case of common cold.	• Fresh juice is extracted from young leaves, mixed with CaCO3 powder, and applies on forehead.
12. *Chlorophytum tuberosum (Roxb.)Baker Family: Liliaceae Parts used: Roots*	• Entire plant used as supplement for overall body growth. • Leaves used to cure cough and cold, and to control bile flow (Hepatic Disorders).	• 5 ml of leaves extract is given orally twice a day with boiled water for a week.

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
13. *Citrullus colocynthis (L.) Soland.* *Family: Rutaceae* *Parts used: Roots*	• Powder of roots and fruits used to cure gastric troubles, and jaundice.	• Mix root and fruit powder in equal quantity, and take orally with cold water twice a day. • Mix root powder, fruit powder and sugar in equal amount. Take one teaspoon of this mixture with water thrice a day for 8-10 days.
14. *Clerodendrum phlomides L. f.* *Family: Verbenaceae* *Parts used: Leaves*	• Leaf paste used to cure boils and swellings. • Ointment prepared from leaves used to cure sprains.	• Leaves are boiled with little amount of sugar. Make paste and apply on boils and swellings. • Leaves of *Clerodendrum phlomides* and *Holoptelea integrifolia* are crushed together, and boiled in pure ghee to make paste. It is used as an ointment.
15. *Commicarpus verticillatus* *Family: Nyctaginaceae* *Parts used: Roots*	• Root paste used to cure boils and swellings.	• Root paste or powder is mixed with lemon juice and apply twice a day on affected areas.
16. *Commiphora wighti (Arn.) Bhandari* *Family: Burseraceae* *Parts used: Bark*	• Gum used to cure dysentery. • Bark decoction used to cure skin diseases and blood purification. • Gum used to reduce body weight.	• Half teaspoon of gum powder is taken orally with milk every day morning for 3-4 days. • 2 to 3 gm of bark powder is dissolved in water, kept overnight. Take half cup decoction twice a day. • Gum is eaten along with food preparations.
17. *Dichrostachys cinerea (L.) W.& A.* *Family: Mimosaceae* *Parts used: Bark*	• Bark (Stem) powder used in urinary troubles and kidney disorders. • Leaves used to cure boils.	• 5 gm of powder with boiled water is consumed twice a day for 7 days. • Crush leaves to make paste and apply on boils.
18. *Enicostema axillare* *Family: Gentianaceae* *Parts used: Entire*	• Plant powder used to cure diabetes, cough and cold. • Plant powder is taken with piper to cure fever and indigestion problems.	• Take two teaspoons of plant powder, boil in a glass of water and prepare decoction. Take half cup of mixture twice a day for 3-4 days.

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
Plant		• Take a teaspoon of powder along with powder of 3 pieces of Piper (*Piper nigrum*) along with water in morning hours for 3-4 days.
19. *Fagonia schweienfurthi L.* *Family: Zygophyllaceae* *Parts used: Entire Plant, Leaves*	• Entire plant used to cure bile. • Leaves used to cure diarrhea. • Plant paste used to heal wounds, cuts, lesions and bruises.	• Take fresh plant parts; boil in enough quantity of water. Take a cup of filtrate twice a day for 4-5 days to cure bile impairments. • Take a teaspoon of leaf paste with water every day in morning hours for a week. • Crush fresh plant material to make paste, and apply on wounds and cuts.
20. *Grewia tenax (Forsk.) Fiori* *Family: Tiliaceae* *Parts used: Fruits*	• Fruit pulp used to cure swellings. • Root powder used to get rid of dysentery.	• Apply fruit pulp on swelled parts thrice a day to cure swellings. • Take a teaspoon of root powder, boil in a glass of water and take orally in morning hours for three days to cure dysentery.
21. *Helicteres isora L.* *Family: Sterculiacaea* *Parts used: Fruits*	• Fruit mixed with mustard oil used to cure body pain. • Fruits be used to cure dysentery.	• Take 3 to 4 fruits and boil in 20 ml mustard oil to make paste. Apply paste on the affected areas. • The fruit is soaked in water overnight to get one cup of reddish water, and is drunk in morning time on empty stomach for 2 to 3 days to cure dysentery.
22. *Indigofera oblongifolia Forsk* *Family: Papilionaceae* *Parts used: Flowers*	• Flower paste used to cure stomach pain in children.	• Crush petals for 15 minutes. Apply on stomach.
23. *Indoneesiella echioides* *Family: Acanthaceae* *Parts used: Entire Plant*	• Plant material used as a health tonic. • Leaves and roots used to cure dysentery, diarrhea and gastric troubles.	• Take 10 ml of plant extract with half tablespoon of sugar powder; consume it twice in a day for 15-20 days. • Take a tablespoon of fresh plant

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
		extract thrice a day for 5-7 days.
24. *Lycium barbarum L.* *Family: Solanaceae* *Parts used: Fruits, Leaves*	• Fruits used for semen enrichment. • Leaves used to cure boils. • Leaf paste used for skin diseases.	• One teaspoon of fruit powder is taken with a cup of cow milk thrice a day for 15 days. • Apply leaf ash on boils. • Apply leaf paste on the affected areas for 5-6 days at regular interval of every 3 hours.
25. *Maerua oblongifolia (Forsk.) A. Rich.* *Family: Capparaceae* *Parts used: Entire Plant*	• Stem paste used to cure skin diseases and Leucorrhoea. • Entire plant used to enhance blood purification and semen enrichment.	• Apply stem paste on affected areas thrice a day for 4-5 days. • Crush entire plant to obtain its juice. Take one teaspoon of juice with one teaspoon of juice of *Ocimum sanctum* (Basil), to be taken orally twice a day for 10-15 days.
26. *Maytenus emerginata (Willd.) D. Hou* *Family: Celastraceae* *Parts used: Bark, Leaves, Young Branches*	• Bark powder used to combat weakness. • Leaves used to cure jaundice. • Young branches used as toothbrush.	• Take a teaspoon of bark powder with a cup of cow milk daily for a month. • Take 7-8 leaves and boil it in a cup of water. Take decoction twice a day for at least a weak. • Brush the teeth with young branches twice a day.
27. *Moringa concanensis Nimmo* *Family: Moringaceae* *Parts used: Bark, Leaves, Young Branches*	• Bark paste used to cure rheumatoid arthritis. • Leaves, bark and flowers used to cure gastric troubles.	• Mix two teaspoons of bark powder in a cup of mustard oil, and boil it till the contents become one third. Massage the affected parts with oil twice a day. • Take equal quantity of leaves, bark and flowers and boil it into water. Take a teaspoon of decoction twice a day for a week.

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
28. *Pentatropis spiralis (Forsk.) Decne.* *Family: Asclepiadaceae* *Parts used: Roots*	• Root powder used to cure normal fever during summer season, and also used to cure dysentery as well as indigestion.	• Material is taken orally with cold water twice a day for a week for successful treatment of dysentery.
29. Premna resinosa Schau *Family: Verbenaceae* *Parts used: Leaves, Stem*	• Leaves used in case of bronchitis. • Stem paste used to cure swellings and body pains.	• Mix 10 gm of leaf powder into 10 ml of honey. Take it orally twice a day for 4-5 days. • Crush stem to make a paste. Apply on swellings or affected areas thrice a day for 3-4 days.
30. *Rivea hypocrateriformis Choicy* *Family: Convolvulaceae* *Parts used: Leaves*	• Leaves used as vegetables to purify blood. • Boiled water of plant parts used to cure miscarriage in cattle.	• Leaves are to be taken for three to four days regularly during monsoon.
31. *Salvadora oleoides* *Family: Salvadoraceae* *Parts used: Leaves, Fruits*	• Leaf paste used as topological applicants to cure swellings. • Fruits used to purify bile.	• Paste of young leaves applied directly on swellings. • Mature fruits (10-15 gm) consumed twice a day for 15 days.
32. *Salvadora persica Linn.* *Family: Salvadoraceae* *Parts used: Leaves, Young Branches, Roots*	• Root bark used to cure arthritis. • Branches and leaves used to cure seasonal cough and cold. • Branches used as toothbrush. • Plant juice used as a female contraceptive.	• Take 5-6 gm of powder with half cup of cow milk once in a day for 30-35 days. • Boil plant parts into water, and take half cup of filtrate for 3-4 days. • Brush teeth with young branch to cure bleeding gums. • Crush plant materials into water and take half cup of juice before sleep at night.
33. *Sarcostemma acidum (Roxb.)Voigt* *Family: Asclepiadaceae* *Parts used: Plant Sap*	• Plant sap directly applies on ticks and mites in animals. • Boiling water used to cure swellings.	• Put 500 gm of plant material into 8-10 liter of water and boil it. Use the same water for bath to cure ticks and mites in animals (cattle).

Species/Family/ Plant part(s) used	**Uses**	**Preparation**
34. *Solanum surattens Burm. F.* *Family: Solanaceae* *Parts used: Entire Plant, Seeds*	• Entire plant sap used to cure uneasiness and hiccups. • Seeds paste with honey used to cure acute tuberculosis and asthma.	• Half cup of juice with cold water and lemon juice to be taken at regular intervals (30-40 minutes a day). • Fresh material with cow milk is to be consumed twice a day for month.
35. *Sterculia urens Roxb.* *Family: Sterculiaceae* *Parts used: Stem, Leaves*	• Paste of stem and leaves used as topological applicants.	• Fresh material is to be applied directly twice a day for 4-5 days.
36. *Tinospora cordifolia (Willd.) Hook. f. &Thoms.* *Family: Menispermaceae* *Parts used: Entire Plant*	• Stem extract used to cure headache and migraine. • Plant paste used in case of skin diseases. • Plant extract used in case when blood passes through urine, and also to cure cough.	• Put 2-3 drops of stem extract into nose to cure headache and migraine. • Apply plant paste on the affected skin parts. • 20-30 ml of juice of fresh plant material is utilized with a glass of cold water to be taken thrice a day for a week.
37. *Taverniera cuneifolia* *Family: Fabaceae* *Part used : Stem*	• Underground stem is used to cure Bronchitis.	• Underground stem is dried in shade and ground to make fine powder. 5 to 10 gm of powder is mixed thoroughly with 10 to 15 ml of honey, and given thrice a day for 10 days to patient.
38. *Tribulus terrestris* *Family: Zygophylaceae* *Part used: Entire Plant*	• Decoction or powder of whole plant used as a general health tonic. • Boiling water of plants given to cattle for more lactation.	• 50-100 ml of decoction along with Basil (*Ocimum sanctum*) powder to be taken twice a day for 15 days. • Fresh plant material to be taken twice a day for 3-4 days.

A lack of ecological knowledge can seriously hinder the conservation and sustainable use of medicinal plant species, especially in the face of anthropogenic threats such as overexploitation and land use change. The paucity of ecological knowledge about medicinal plants is a serious problem for resource managers. Today, managers striving to balance conservation and community development goals need ecological information on medicinal

plant species in order to identify the sustainable level of disturbance and harvesting **(McGeoch *et al.*, 2008).** In addition, collective actions of research institutes and non-government organizations have been recognized as important links for bridging the gaps between biodiversity conservation and management **(Leach *et al*., 1999; Ladio and Lozada, 2009).**

Conclusion

The study revealed that 90% tribal people are partially dependent on the forest and forest products for their primary health care. Moreover, the results of questionnaire survey from key informants revealed that the medicinal plant resources and the traditional knowledge of their uses among tribal communities are depleting day by day due to lack of awareness campaign. It is recommended to take immediate and appropriate conservation action plan to protect the ecosystem of the Tapkeshwari Hill Range (THR) for sustainable use of medicinal plants. Besides, Ecologically Sensitive Sites (ESS) be established for harboring viable populations of such important plant species **(Joshi and Soni, 2013)**. The tribal people of THR also felt the necessity of planting potential medicinal plants on a large scale in the degrading habitats in and around THR along with the adjacent wastelands. Such programs may also provide the alternative livelihood opportunities to the rural population to sustain their lives to generate their economy sources **(Gadgil *et al*., 1996)**. This would certainly reduce the anthropogenic interventions of the medicinally important plant species growing naturally in the forests of Tapkeshwari Hill Range (THR), Kachchh Arid Ecosystem Gujarat, India.

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