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Status of the medicinal plants in Tharawada-Gandher Reserve Forest of Kachchh, Gujarat and the ethno-medicinal practices of local community

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Since few decades, the awareness on the utilization of traditional medicinal system to cure various diseases/disorder gained significant importance in human being. The revival of traditional knowledge on medicinal plants is important for medicinal practices in rural areas. In the mean time, the population of medicinal plant species are also depleting in rapid pace. Therefore, an attempt was made to understand the status of medicinal plants, their uses and the associated traditional knowledge of villagers in TGRF area. A total of 28 medicinal plant species recorded in the area. Some important medicinal plants like *Enicostema axillare, Cynadon dactylon, Commiphora wightii, Capparis decidua* etc. are also recorded from the area which is traditionally used by local people from a long time. It was also found that, 26 types of health problem cured by the recorded 28 species of medicinal plants by traditional medicinal practices. Among the recorded medicinal plants most of them are herbaceous in nature. The study concluded that TGRF is one of the important areas for medicinal plants and local people have rich knowledge on traditional medicinal practices which need to be conserving for future.

Keyword: Medicinal plants, Tharawada-Gandher RF, Traditional knowledge, Kachchh.

1. Introduction

Local people in many parts of India are using traditional medicine prepared from medicinal plants or animals found in their locality. Use of medicinal plants to cure various diseases is a practice from time immemorial. In present times the demand of Ayurveda; Unani; Homoeopathy and Siddha medicine has increased considerably due to increasing awareness among the human population, industrialization of traditional medicinal practices and it's easy access, the increasing demands of medicinal plants exerts immense pressure on many wild plant species[1], nevertheless, which results in depletion of wild plants and posing threats to many species[2]. The wild plants are the major source of treatment for poor people residing in wilderness and remote areas where access to get modern health care facilities is difficult. In many developing countries, approximately 80% of their population depends on the traditional medicines to meet their healthcare needs[3]. The depletion of medicinal plants will endanger the easy medical treatment for people and loss of gene pool which are source of many vital present day medicines and also limits the future scope in deriving natural drugs.

Kachchh district of Gujarat has rich floral diversity including medicinal plant species which are distributed all over the district. The local people of this district have a wide range of ethno-medicinal knowledge and they have long practices to use various wild plants to cure their diseases[2]. Kachchh district is also rich in some species like *Commiphora wightii, Capparis cartilaginea, Boerhavia diffusa, Tribulus terrestris,* etc. having high medicinal potential which are being over exploited for its commercial values[4].

Very scanty information is available on various aspect of flora of Kachchh district. Thaker reported 511 species of useful plants belonging to 75 families from Kachchh district[5]. Bhatt documented 518 species of flowering plants from western Kachchh[6]. Dixit and Subba Rao studied the distribution and habitat characteristics of *Commiphora wightii* in arid region of Kachchh[7]. Vyas documented 46 plant species of medicinal values belonging to 26 families from Kachchh district[8]. Joshi studied the ethno botanical plants of Bhuj and Mandvi taluka[9] and GUIDE reported 640 species of flowering plants[10] and among them, 402 species are categorized as medicinally important. Patel *et al.* reported 35 species of medicinal plants from Dhinodar Hills of Kachchh[11].

The uses of medicinal plants to cure various diseases in many parts of India as well as world are less understood. Apart from the uses, the distribution range of each medicinal plant is feeble understood. The documentation of various uses of medicinal plants and their distribution are much essential for proper conservation and management of medicinal plant species. However, knowledge on medicinal properties of many species has never been documented opportunity. Hence, it is essential to document the traditional knowledge existing in local communities for conservation and sustainable use of medicinal plant resource. With the above view, the present study was carried out in Tharavada-Gandher reserve forest located in Kachchh district.

2. Materials and Methods

2.1 Study area

The Tharavada-Gandher reserve forest (TGRF) is located partially under Bhuj and Anjar taluka of Kachchh district **(Figure 1)** which falls under the desert bio-geographic zone of India. The landscape of TGRF is a hilly track and the vegetation of the area is a admixture of thorny scrub forest and open forest. The area is also under the invasion of alien plant, *Prosopis juliflora* locally called as *"Gando Baval"* which speeded over considerable area of TGRF. The maximum elevation of the moderately undulating terrain is 165 meter from Mean Sea Level. The temperature of the study area ranges from 9°C during winter to 45 ^{0}C in summer season. The rainfall of the area is scanty; occurring through south-west monsoon between June and September, with an average annual rainfall of about 319 mm. The area falls under arid and semi-arid bioclimatic zone of India.

2.2 Methodology

The aim of this study was to document the wild plants used for medicinal purposes by the local communities in their traditional health care system, and to assess the status of medicinal plant species in TGRF. Medicinal plants inventory in TGRF was carried out during the month of August and September, 2011. Intensive surveys were carried out to collect data on traditional knowledge on uses of medicinal plants and ethno-medicinal practices by local communities of villages in and around the TGRF. The target groups were interviewed based on their occupation which includes pastoralists, farmers and others. A total of 53 individuals of six different villages were formally interviewed for this study **(Figure 1)**.

Quantitative assessment of the medicinal plants was made by surveying 68 random plots laid in the TGRF. The sampling locations were identified and selected based on floristic composition, topography and terrain. On the basis of habits of wild plant, three different size of quadrate viz. 10m X 10m for trees, 8m X 8m for shrub and climber, and 1m X 1m for herb and

grasses were laid down for phyto-sociological analysis of the wild medicinal plants[12-13].

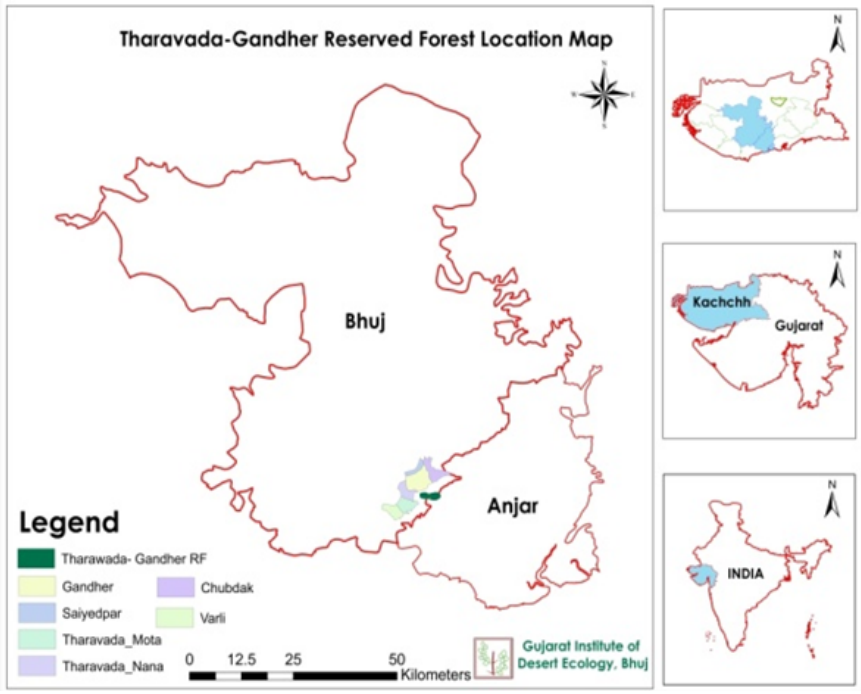

Fig 1: Location of the study area in Kachchh district of Gujarat state

3 Results and discussion

3.1 Floral diversity

The detailed floristic survey reveals that, a total of 215 plant species belonging to 47 families and 142 genera were recorded from TGRF. Among the 47 families, *Poaceae* is the largest family with 31 species, followed by Convolvulaceae (16 species), and about 18 families represents single species only. Among the genera, *Acacia*, *Euphorbia* and *Ipomoea* are dominant in respect of number of species which reported five species each. Out of 142 genera reported from the area, 98 genera are monotypic. Life form status of the floral species recorded from TGRF showed that herb was the dominant life form representing 102 species (47.44%), followed by grasses with 31 species (14.42%). The life forms like climbing shrub, sarmentose shrub and woody twiner represents only single species from the area. On analysis of the recorded 215 plants it was found that 28 species of wild plants are being used by the local community for traditional medicinal practices.

Micro-habitat like *Acacia senegal- Acacia nilotica*, *Acacia senegal-Euphorbia caducifolia,* and *Euphorbia caducifolia* are the common habitat in TGRF. Some threatened plant species recorded from the TGRF which includes; *Commiphora wightti* which is closely associated with *Acacia Senegal, Euphorbia caducifolia* was reported in most part of TGRF and was also found to be closely associated with *Grewia tenax, Premna resinosa* and *Grewia villosa*. The relative frequency and density of *Commiphora wightii* was recorded high in the TGRF.

3.2 Quantitative assessment of medicinal plants

On quantitative analysis of the 28 medicinal plants recorded from the TGRF, *Enicostema axillare* (13.17 %) was found to be the most frequent species of medicinal plant in the study

area. Another medicinal plant species with high relative frequency were *Cynodon dactylon* (10.97%), *Grewia tenex* (10.03%) *Commiphora wightii* (9.71%) and *Euphorbia caducifolia* (6.58%). Among medicinal plant species, *Enicostema axillare* showed highest density (90000 individual/ha) followed by *Cynodon dactylon* (82500 individual /ha) and *Achyranthes aspera* var. *argentea* (62500 individual /ha). Among the perennial species of medicinal plants, the density of *Commiphora wightii* (2000 individual/ha) was recorded highest, followed by *Capparis decidua* (1600 individual /ha), *Grewia tenex* (1555.56 individual /ha), *Acacia senegal* (1100.00 individual /ha) and *Cassia italica (*1066.67 individual /ha) **(Table 1)**.

Table 1: Relative frequency and Density of recorded medicinal plants in Tharawada-Gandher RF

Sl. No	Species	No. of individual	Relative frequency (%)	Density (no. of indiv./ha)
1	*Acacia nilotica* (L.) Del. subsp. *indica* (Bth.) Brenan	8	0.94	355.56
2	*Acacia senegal* (L.) Willd.	25	3.45	1111.1
3	*Achyranthes aspera* L. var. *argentea* Hook	25	0.94	62500
4	*Aerva persica* (Burm.f.) Merrill	32	1.25	1422.2
5	*Aloe barbandensis* Mill.	12	0.63	533.33
6	*Asparagus racemosus* Wild. *var. javanicus* (Kunth) Baker	18	4.39	800
7	*Azadirachta indica* A. Juss.	4	0.63	177.78
8	*Calotropis procera* (Ait.) R. Br.	14	0.94	622.22
9	*Capparis cartilaginea* Decne.	2	0.63	88.89
10	*Capparis decidua* (Forsk.) Edgew.	36	5.02	1600
11	*Cassia italica* subsp. *micrantha* Brenan	24	2.51	1066.7
12	*Citrullus colocynthis* (L.) Soland.	9	2.51	400
13	*Commiphora wightii* (Arn.) Bhandari	45	9.72	2000
14	*Corchorus depressus* (L.) Stocks	13	4.39	32500
15	*Cucumis callosus* (Rottl.) Cogn.	12	2.82	533.33
16	*Cynodon dactylon* (L.) Pers.	33	10.97	82500
17	*Datura metel* L.	9	0.63	400
18	*Desmostachya bipinnata* (L.) Stapf	11	1.25	27500
19	*Enicostema axillare* (Lamk.) Roynal	36	13.17	90000
20	*Euphorbia caducifolia* Hains.	23	6.58	1022.2
21	*Grewia tenax* (Forsk.) Fiori	35	10.03	1555.6
22	*Launaea procumbens* (Roxb.) Ram. & Raj.	6	4.70	15000
23	*Leptadenia pyrotechnica* (Forsk.) Decne.	6	0.63	266.67
24	*Prosopis cineraria* (L.) Druce	5	1.25	222.22
25	*Salvadora oleoides* Decne.	4	2.19	177.78
26	*Salvadora persica* L.	6	5.02	266.67
27	*Solanum surattense* Burm. f.	8	2.51	20000
28	*Tamarindus indica* L.	4	0.31	177.78

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3.3 Documentation of traditional knowledge on medicinal plants

On the basis of questionnaire survey and records on wild plants it was found that local people are using 28 wild plants as medicinal purposes for curing their diseases (Table 2). It was recorded that the pastoral communities of TGRF and adjoining villages are using maximum number of medicinal plants for their disease treatments in relation to other communities. The villages of Tharawad nana used 11 out of 28 recorded medicinal plants for various treatments while Chubdak and Saiyadpar used only 4 species of total recorded medicinal plants. These medicinal plants are used for treatment and cure of 26 types of health problems and diseases.

Out of the 28 recorded species used by local community for their medicinal practices, 6 species were tree, 4 species were shrub, 5 under shrub, one climber, one twiner and the rest of 11 species were herbaceous. The data on plant part used for various medicinal purposes reveals that whole plant of 4 species; leaves of 12 species and roots of 5 species are used for medicinal purposes (Figure 2). On analysis of the various disease cured and health problem overcome by the by medicinal plants of TGRF (Figure 3) it was found that respiratory and digestive problem were cured by 5 species of plants, wound healing by 3 species and 3 species of plants were used as pain killer. It was also found that 5 species of plant are used for health tonic, 2 species each used for curing skin diseases, diabetes, dental problems, etc. It was assessed that only *Commiphora wightii* is used for curing three types of health problems, 10 species are used for curing two different types of health problems and 15 species are used for curing one types of health problem by the local community in their traditional health care system (Table 2).

Based on the survey and discussion with the various local stakeholders it was found that *Commiphora wightii* (Kharo Gugar or Guggal), *Tribulus terrestris*, *Asparagus racemosus* var. *javanicus*, *Enicostema axillare*, *Fagonia schweienfurthii, Citrullus colocynthis* and *Capparis decidua* are predominantly used in the traditional health care system by the villagers in vicinity of the TGRF.

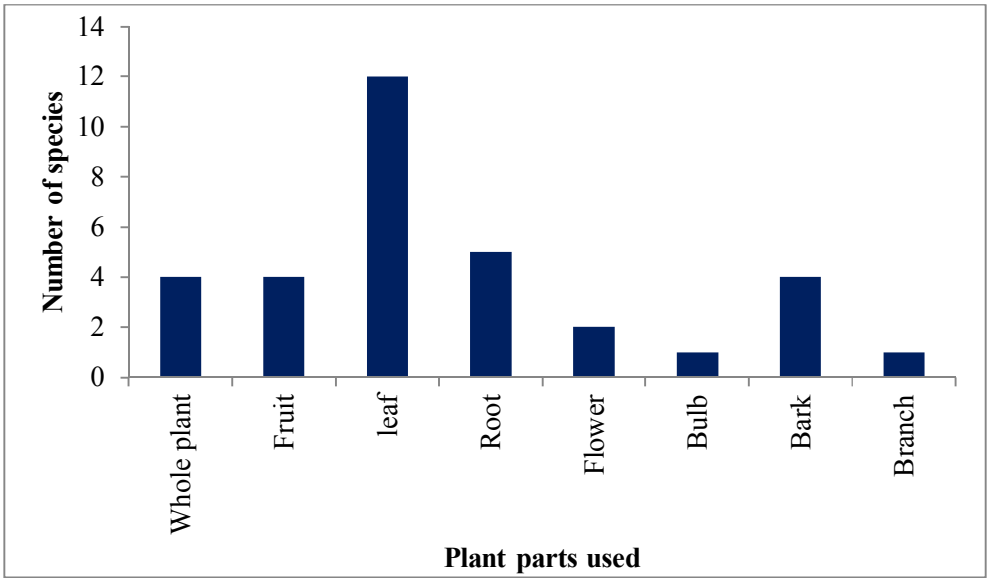

Fig 2: various plant parts of medicinal species used for traditional health care system in TGRF, Kachchh, Gujarat

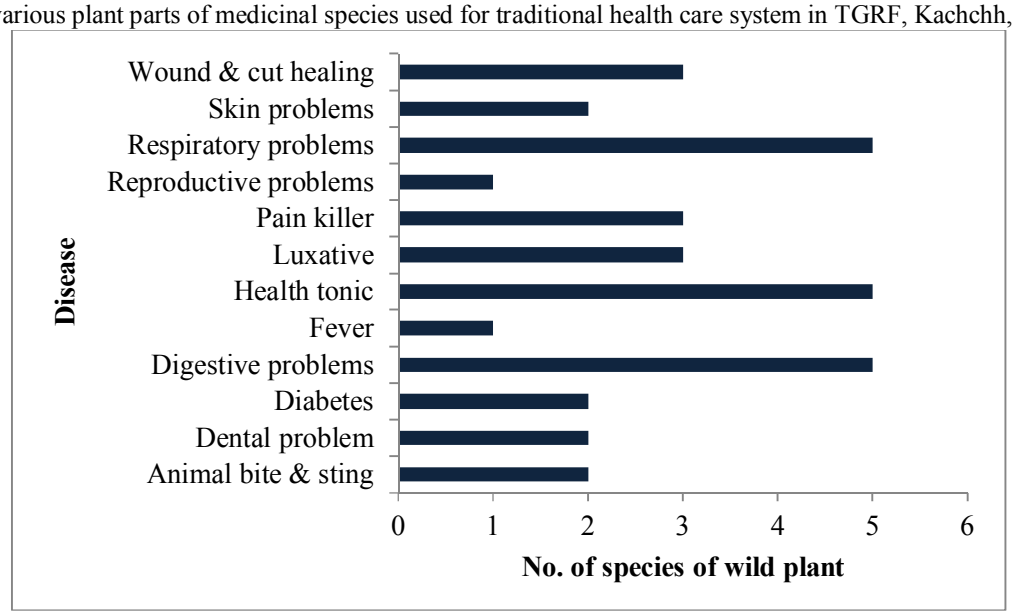

Fig 3: No. of species of wild plants used for traditional system of health care by local community of TGRF, Kachchh, Gujarat

Table 2: Medicinal uses of recorded medicinal plants from two MPCAs

Sl. No.	Plants species	Vernacular / Local Name	Habit	Part used	Medicinal uses
1	*Citrullus colocynthis* (L.) Soland.	Truja Val, Tru Val, Tru Deda	Climber	Fruit	Piles and urinary disorders
2	*Achyranthes aspera* L. var. *argentea* Hook. f.	Vado Andhado	Herb	Bark	Skin Diseases (itching)

Sl. No.	Plants species	Vernacular / Local Name	Habit	Part used	Medicinal uses
3	*Aerva persica* (Burm.f.) Merrill	Bou, Bour	Herb	Inflor-escence	Snake bite
4	*Alysicarpus monilifer* (L.) DC. var. *monilifer*	-	Herb	Whole plant	Diarrhea
5	*Azadirachta indica A. Juss.*	Rapatri	Herb	Roots and leaves	Joint pain, urinary problems
6	*Corchorus depressus (L.) Stocks*	Mundheri	Herb	Leaves	Heath tonic
7	*Cynodon dactylon (L.) Pers.*	Jangli Dungri	Herb	Bulb	Scorpion stinging, sweating
8	*Datura metel* L.	Dhaturo	Herb	Leaves, root & fruit	Joint pain
9	*Enicostema axillare* (Lamk.) Roynal	Mame Cho, Mamej, Kadvi Bhaji	Herb	Leaves	Diabetes
10	*Fagonia schweienfurthii* (Hadidi) Hadidi	Dhramau, Dhamaso, Kandhera	Herb	Whole plant	Skin disease
11	*Launaea procumbens* (Roxb.) Ram. & Raj.	Vadi Gurval, Vadi Gemar	Herb	Leaves	Fever
12	*Pupalia lappacea* (L.) Juss.	Gadar Bhurat, Ridha Bhurat	Herb	Flowers	Sour throats
13	*Capparis decidua (Forsk.) Edgew.*	Ker, kerad	Shrub	Root	Low back and joint pain
14	*Grewia tenax* (Forsk.) Fiori	Gangati, Gangi, Gangni	Shrub	Roots	Female reproductive system problems
15	*Premna resinosa* Schau	Nidhi Kundher	Shrub	Leaves	Laxative
16	*Prosopis juliflora* (Sw.) DC.	Gando baval	Shrub	Fruit & leaves	Scorpion stinging & wound
17	*Commiphora wightii* (Arn.) Bhandari	Gugar, Gugariya, Gugar Jo Zadvo	Tree	Whole plant	Laxative, asthma, stomachic

Sl. No.	Plants species	Vernacular / Local Name	Habit	Part used	Medicinal uses
18	*Acacia nilotica* (L.) Del. subsp. *indica* (Bth.) Brenan	Deshi Baval	Tree	Young branches, barks	Laxative, toothache
19	*Acacia senegal* (L.) Willd.	Kher	Tree	Bark	Wound, cut
20	*Salvadora oleoides* Decne.	Mithi Zar, Mithi Pilujo Zad	Tree	Leaves	Asthma
21	*Salvadora persica* L.	Khari Zar, Pailu	Tree	Whole plant	Pain of teeth, skin disease
22	*Tamarindus indica L.*	Khati Amabli	Tree	Bark	Blood purification, vomiting
23	*Cucumis callosus (Rottl.) Cogn.*	Kotimba	Twiner	Fruit	Wound, tonic
24	*Aloe barbandensis Mill.*	Kuvar	Under shrub	Leaves	Tonic
25	*Asparagus racemosus* Willd. *var. javanicus* (Kunth) Baker	Akal Kandha Ni Val, Chini Ji val	Under shrub	Roots	Lactation, dysentery
26	*Calotropis procera* (Ait.) R. Br.	Akado,Aak	Under shrub	Mature leaves	Asthma, cough
27	*Capparis cartilaginea* Decne.	Parvati rai	Under shrub	Leaves	Diabetes
28	*Cassia italica subsp. micrantha* Brenan	Mindhiavar, Pat Mindhiavar	Under shrub	Leaves	Helps in digestion

4 Discussion

The existence of human on planet earth depends on diverse species of plants for its medicinal and other beneficial properties. The traditional knowledge of human being on medicinal values of plant is developed through course of time by co-existence with surrounding floristic diversity. During the past few decades, the traditional knowledge on medicinal properties of plants gathered by many generations is declining rapidly. The erosion of traditional knowledge is primarily due to development of modern health care facilities, commercialization and socio-economic changes[14] and lack of interest on learning the knowledge by indigenous community[15-16]. Some major works on floristic and ethno-botanical studies reveals that Kachchh district is a rich area for wild plant usages in medicinal purposes. Many of the plant species were used by people for long period of time of human history for medicinal purpose which was documented in Vedic literature includes; Charak Samhita and Sushruta Samhita[17]. A large number of areas of the country were covered with forests which yielded a number of medicinal plants and these plants were extensively used in Aurvedic system of medicine since many centuries[17]. Some of the scattered work on ethno-medicine of wild plant resource had been done in various parts of Gujarat. Thaker worked

on the useful plants of Kachchh and recorded a total of 511 plant species[5]. Apart from the useful plants, many of the medicinal plants from Gujarat and Kachchh district[18-19] were also reported by some workers viz; Vyas documented 46 plant species of medicinal values belonging to 26 families in Kachchh district[8], Seliya and Patel recorded a total of 30 climbers used as medicinal values from the rural areas of Saraswati river basin of Patan district in North Gujarat[20], 37 ethno-medicinal plants species documented in Tapkeshwari hill, Kachchh[4]. Similarly, the present study recorded 35 species of ethno-medicinal plant from the Dhinodar Hill situated in the fringe area of Rann of Kachchh[11]. The phyto-sociological analysis revealed that *Cynodon dactylon* and *Enicostema axillare* are abundant in TGRF and both these species are known for their high medicinal values and widely used by local people. *Commiphora wightii*, an important medicinal plant and also a sacred plant for Kachchh is distributed in patches in TGRF. There are species like *Fagonoa schweienfurthii, Enicostema axillare, Achyrathes aspera* var. *argentea, Corchorus depressus* and *Cassia italica*, which are commonly found in TGRF. Some species like *Capparis cartilaginea, Citrullus colocynthis, Leptadenia pyrotechnica* and *Prosopis cineraria* have high medicinal values but their occurrence was very low. Joshua *et al.* highlighted that medicinal plants along with other natural plants of Kachchh district are under threats by various kinds of habitat degradation and exploitation[21].

5 Conclusion

The total number of plant species and medicinal species recorded from this study showed that TGRF is a rich area in term of floral diversity and medicinal plant species in spite of being located in an arid zone of the country. This record of the present study reveals that a total of eight threatened plant with their significant role in traditional medicinal value in this area shows the very importance of the area. This study also recorded some plant species viz; *Commiphora wightii, Capparis cartilaginea, Asparagus racemosus, Corchorus depressus, Cassia italica, Enicostema axillare* and *Fagonia schweienfurthii*, having high medicinal values. These species require special attention to be conserved for their medicinal use by the local community and for commercial uses in a sustainable manner in future. The study reflects that local people are using these medicinal plants for long time and they have rich ethno-medicinal knowledge passed down from generation to generation through oral communications. During the study it was also found that the traditional knowledge relating to ethno-medicinal is declining day by day mainly due to lack of interest and proper documentation of the knowledge and passing those wisdom to the next generation. Therefore, this study recommends protection and conservation of wild plant of the area for sustainable use in future and a detailed documentation of ethno-medicinal knowledge for the use of future generation.

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7. References

1. Chauhan NS. Important medicinal and aromatic plants of Himachal Pradesh. In: Medicinal and Aromatic Plants. Eds. Negi, S. S., Srivastava, R. K. and Bisht, N. S., Indian Forester, Dehradun.2007; 15-32 p.
2. Pandey CN, Raval BR, Mali S and Salvi H. Medicinal Plants of Gujarat. Gujarat Ecological Education and Research (GEER) Foundation, Gandhinagar. 2005; 410 p.

3. FAO. WHO Fact Sheet No. 271, June 2002.
4. Patel RM, Dabgar YB and Joshi PN. Some noteworthy ethno-medicinal plants of western Kachchh, Gujarat. Life science leaflets, 2010; 9, 244-250 p.
5. Thaker JI. Plants of Kutch and their utility (In Gujarati). Rajkot. 1926.
6. Bhatt JB. Studies on the Flora of Western Kachchh. Ph. D. Thesis. M. S. University, Baroda. 1993
7. Dixit AM and SV Subba Rao. Observation on distribution and habitat characteristics of Gugal (Commiphora wightii) in the arid region of Kachchh, Gujarat (India). Tropical Ecology 2000; 41 (1): 81-88.
8. Vyas, SP. Ethno-medicinal plants of Kachchh. Ind. J. Environ. Sci. 2001; 6 (1): 91-94 p.
9. Joshi PN. Study of Ethnobotanical Angiosperms of Bhuj and Mandvi Talukas of Kachchh, Gujarat. Ph. D Thesis, Bhavnagar University, Bhavnagar. 2002
10. GUIDE. Study on medicinal plants of Kachchh district. Gujarat Institute of Desert Ecology (GUIDE); Bhuj-Kachchh (Gujarat), India. 2002; 93 p.
11. Yatin S. Patel, Rohit M Patel, Arun Kumar Roy Mahato and Pankaj N Joshi. Status and diversity of Ethno-medicinal plants of Dhinodhar hill, Kachchh District, Gujarat. International Journal of Plant Animal and Environmental Science, 2013; 3(1):265-273
12. Mishra R. Ecology Work. Published by Mohan Primlani, Oxford & IBH Publication Co., New Delhi. 1968; 244 p.
13. Mueller-Dombois D and Ellenberg H. Aims and methods of vegetation ecology. John Wiley and Sons, New York, London. 1967; 545 p.
14. Gadgil MF, Birkes and C Folke. Indigenous Knowledge of Biodiversity Conservation. Ambio, 1993; 22, 151-156 p.
15. Silori CS and Rana A. Indigenous knowledge on medicinal plants and their use in Narayan Sarovar Sanctuary, Kachchh. Ethnobotany 2000; 12, 1-7 p.
16. Silori CS, Dixit AM. Gupta L., Mistry N. Observations on medicinal plant richness and associated conservation issues in district Kachchh, Gujarat. In Medicinal Plant: Utilization and Conservation, Pravin C. Tivedi (ed). Aavishkar, Jaipur, xv, 432p. 2004
17. Pushpangadan. Ethnobiology in India - A Status Report. All India Coordinated Research Project on Ethnobiology. MoEF, GoI, New Delhi. 1995.
18. Blatter EJ. On the Flora of Kutch. J. Bom. Nat. Hist. Soc. 1908; 18: 756-777 p.
19. Silori CS, Dixit AM, Gupta LM and Mistry N. Observation on Medicinal Plant richness and associated conservation issues in district Kachchh, Gujarat. In: Medicinal Plant:s: Utilization and Conservation. (ed.) P.C. Trivedi. Rajasthan University. 2005.
20. Seliya AR and Patel NK. Ethnomedicinal uses of climbers from Saraswati river region of Patan district, North Gujarat. Ethnobotanical leaflets, 2009; 13, 865-872 p.
21. Joshua Joshua, Wesley Sunderraj SF and Joshi PN. Survey of Threatened Plants in Kachchh Desert, Gujarat. 2008; 101-108p. In: Rawat, G.S. (Ed.). Special Habitats and Threatened Plants of India. ENVIS Bulletin: Wildlife and Protected Areas, Vol. 11(1). Wildlife Institute of India, Dehradun, India.