



Quantitative Ethno-Medicinal Studies of Some Trees and Shrubs from Southern Rajasthan

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Abstract

Ethno-medicinal survey of various tribal localities of Southern Rajasthan reveals 53 therapeutic usages of 75 plants for 15 body system. Quantification of documented data reveals *Oroxylum indicum* and *Madhuca indica* has maximum use value followed by *Gmelina arborea* and *Diospyros melanoxylon* while the *Wrightia tinctoria* has low therapeutic value. Accordingly *Oroxylum indicum* also revealed high % fidelity level and relative index, indicating popularization of same for its high healing potential. Ten plants i.e *Ailanthus excelsa*, *Anogeissus latifolia*, *Commiphora wightii*, *Diospyros melanoxylon*, *Gmelina arborea*, *Holoptelea integrifolia*, *Madhuca indica*, *Oroxylum indicum*, *Sterculia urens* and *Tamarindus indica* are used for maximum maladies. Quantification through informant consensus factor (ICF) for tree barks usage reveals Bhil, Meena and Garasia tribes had no degree of agreement on the usage of *Commiphora wightii* Damor tribes uses the same and similar data was also obtained for *Madhuca indica*. The Informant consent factor less than 50 percent for communities residing in the same niche indicates community specific traditional therapeutic approach. Hence, in present study these two species i.e *Commiphora wightii* and *Madhuca indica* indicated least consent among tribes.

Keywords: Use Value, Percent fidelity level, Relative index, Relative frequency citation, Informant consensus factor, Southern Rajasthan.

Introduction

Among plant wealth, tree occupy a significant role as they dominate forest flora and are long lived companions of tribals. The tree bark marks remarkable plant part for possessing unique biochemical constituents. The term *bark*, as commonly used in connection with woody plants, refers to the tissue external to the vascular cambium. It is a nontechnical and comprehensive term, which includes primary phloem, cortex, and epidermis in stems and roots with primary growth; and secondary phloem, rhytidome, and varying proportions of cortex and primary phloem in stems and roots with secondary growth. Several authors have used the term *bark* (*Borke*) in a technical sense for rhytidome, and *rind* (*Rinde*) for all tissues external to the vascular cambium

(Esau, 1953). Wood bark metabolites are a major part of extracts, which are a soluble material comprised of water and organic solvents. Bark posses secondary metabolites of tannin group which have unique properties due to which it is used for present study. Extracts are a natural chemical mixture, which varies from sample to sample in a species and therefore forms a source of antifungal, antibacterial and antioxidant pool (Fengel and Wegener, 1989; Hafızoğlu, *et al.*, 2011; Belgacem and Pizzi, 2016).

Rajasthan is the largest state of the India located in the North Western part of India. Geographically it lies between 23° 3' to 30° 12' longitude and 69° 30' to 78° 17' latitude. The

tribal dominated Southern part of Rajasthan harbour vast diversity of vegetation. It includes subtropical evergreen forest of *Boswellia serrata*, *Diospyros melanoxylon*, *Dendrocalamus strictus*, *Bombax ceiba*, *Madhuca indica*, *Tectona grandis*, *Anogeissus latifolia* and *Balanites aegyptiaca*. These forests are inhabited by the major tribes of the State viz. Bhil, Meena, Garasia, and Damor. The trees growing in vicinity are used by these tribal communities for various therapeutic purposes besides being a good source of 5 F i.e. food, fodder, fuel, fibre and fertilizer. Bark in addition to the chief constituent lignin possess good amount of various secondary metabolites, and a rich array of phenols and flavanoids and are therefore combat oxidative stress (Akbari, *et al.*, 2022).

With the evolution and progression in digital world the information documented through tribal communities has to be checked for its contamination as the data is highly influenced by social media buzz. Quantitative techniques have been used in ethnobotany to compare the uses and the cultural importance of different plant species. Such analyses are of great scientific interest as they reflect cultural value systems and they may also aid in the conservation of biodiversity (Albuquerque, *et al.*, 2006). It is expected that people will be motivated to conserve resources that are most important to them, in contrast to resources perceived as less useful. The quantitative studies of Rajasthan ethnobotany specifically includes work of Arora and Matiya (2017), Lohar and Arora (2019a,b), Arora and Lohar (2019).

Materials and Methods

A. Field Studies

(i).Documentation of ethnomedicinal plants- For the documentation of ethno-medicinal plants, field surveys were carried out all around the year from 2019 to 2020 in various tribal, rural and sub-rural pockets. Various localities of Southern Rajasthan (District-Udaipur, Dungarpur and Banswara) were selected to unearth the information from all the dominating tribes i.e Bhil, Meena, Garasia and Damor. For recording and

documentation, field interviews were made from different practitioners i.e. ritual therapist, herbalist, grain diviner, priest and ancestral practitioner through local transcends to avoid language ambiguity and data were recorded in information retrieval form. As per guidelines of convention on biological diversity, prior informant consent was obtained for usage/s.

(ii).Authentication of Primary data- In order to determine the authenticity of information collected during field visit, data was cross checked with published data of the same array and region. Data was also authenticated in criss cross manner by interviewing other informants (Lohar and Arora, 2019a).

(iii).Preparation of herbarium sheets- Plant specimens was collected and herbarium sheets were prepared with all related information. Plants were identified up to species level through flora of region and prior work and accession numbers were assigned accordingly. Herbarium sheets were deposited in Department of Botany, B N University, Udaipur (Rajasthan) for further reference.

B. Tabulation and Quantitative Analysis

(i).Tabulation of field data- Field data was tabulated for following three factorials-

- On the basis of informants report.
- On the basis of therapeutic applications for body system.

(ii).Quantitative Analysis -Documented data was further analyzed for - Use Value (UV), Percent fidelity level (% FL), Relative index (RI), Relative frequency citation (RFC) and Informant consensus factor (ICF).

Use value- UV demonstrates the relative importance / usefulness of plants known locally. UV was calculated using the following formula (Gazzaneo, *et al.*, 2005).

$$UV = \sum U_i / N$$

U_i is the number of uses mentioned by each informant for a given species and N is the

total number of informants. The values are high when there are many use-reports for a plant, implying that the plant is important, and low (approaches to 0) when there are few use-reports.

Percent Fidelity Level

Percent FL is the ratio between the number of informants who independently suggested the use of a species for the same major purpose and the total number of informants who mentioned the species for any use. It is calculated as mounted by Friedman, *et al.*, (1986).

$$FL (\%) = (N_p/N_u) \times 100$$

N_p is the number of informants that claimed a use of a species to treat a particular disease, and N_u is the number of informants that used the plants. High FL values (near 100%) are obtained for plants for which almost all use-mentions refer to the same purpose, that is the plants (and their use for a particular purpose) are most preferred, whereas low FLs are generally obtained for plants that are used for many different purposes.

Relative Index (RI)

RI is the comparison of species for their pharmacological importance for revealing its capacity to treat more than one health problem. Regardless of the number of informants citing the species, it is calculated on the basis of normalized number of pharmacological properties attributed to it and the normalized number of body system (BS) it affects (Bennett and Prance, 2000). It is calculated as -

$$RI = [(RelPH + Rel BS) / 2] \times 100$$

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

Relative Frequency Citation (RFC)

RFC is an index which highlights the dispersion of usage among the informants. Relative frequency of citation (RFC) index is obtained by dividing the number of informants mentioning a useful species (FC or frequency of citation), by the total number of informants in the survey (N). RFC value varies from 0 (when nobody refers to a plant as a useful one), to 1 (when all the informants mentioning it as useful) (Tardio and Pardo, 2008). RFC index, which does not consider the use-category (UR or use-report is a single record for use of a plant mentioned by an individual) and RFC calculated by the following formula:

$$RFCs = FCs / N$$

Informant Consensus Factor (ICF)

ICF is used to analyze if there was an agreement in the use of plants in the ailment categories between the plant users in the study area i.e to test the homogeneity of the informant(s) knowledge. It also reveals intra-cultural and intercultural importance and validation. The ICF /Fic was calculated using the following formula (Heinrich, *et al.*, 1998).

$$ICF = N_{ur} - N_t / N_{ur} - 1$$

N_{ur} refers to the number of use-reports for a particular ailment category and N_t refers to the number of taxa used for a particular ailment category by all informants. The product of this factor ranges from 0 to 1. A high value (close to 1.0) indicates that relatively few taxa are used by a large proportion of the informants. A low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness or 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 1) if there is a well-defined selection criterion in the community and/or if information is exchanged between informants.

The data obtained for each quantitative parameter was latter on compiled to form a sum up table to analyze and verify the role of each species.

Statistical Analysis

The results were expressed as mean \pm standard error mean (SEM) of three replicates. Statistical significance was determined using Student's t-test. P value < 0.001 as compared to mean value was considered as utmost significant.

Results and Discussion

Traditionally trees have proved themselves through prolonged ancestral therapeutic paths and therefore form an important pave among tribes, without signalling any toxicity. As trees are the part of longevity stretch they become important companions of the people residing in their vicinity. Among various tree parts that are deployed for various ailments, tree bark are generally used as infusions, decoctions or extracts as they are hard and accomplished by suberin and cutin. Bark also forms important therapeutic recipes as they can be stored for longer periods as a whole or in a dried powder form without indulgent of any physical and chemical processes.

The Aravalli hills form the skyline of northwest India *i.e.* Gujarat, Rajasthan, Haryana states and Delhi union territory stretching in the southwest and north-west direction. These hills mainly represent tropical dry deciduous forest which is one of the world's most threatened ecosystems (Phillips and Gentry, 1993a,b; Phillips,1996). The rapid conversion of tropical forests for agriculture, timber production and other uses has generated vast, human-dominated landscapes with potentially dire consequences for tropical biodiversity. These hills also harbor various social categorized populations. Native people are the janitors of indigenous traditional knowledge associated with their surrounding biological resources. These resources are utilized for various purposes *viz.* food, fodder, fiber, medicine, cosmetic, ritual code etc. and therefore, form a spine of ethnic life. Rajasthan is also a state of cultural heritage and harbors various scheduled, denotified, nomadic and semi-nomadic tribes. These tribes port in various geographical areas of Aravallis among which the southern region forms the core territories of the Bhil and

Meena tribes. The minor tribes include Dhanka (Talvi, Tetariya, Valvi), Kathodia (Katkari), Naikda (Nayaka), Koli dhor (Tokre Koli, Kolcha), Pateliya, Dangi and Kokna (Kukni, Kukna). These major and minor tribes are the custodians of local/indigenous knowledge and preserve a rich array of plant diversity. The therapeutic usage among these tribes vary significantly and often data retrieved through ethno-botanical survey is contaminated and deviated due to non continuous dispersion, linguistic and cultural ambiguity and mythological beliefs of the resource tribal men. Quantitative analysis of such survey data projects the significant and authenticated usage.

For ethno-medicinal documentation various practitioners as well as non- practitioners were chosen at random. Respondents were either native born or had been living in the region for at least 20 to 30 years. Informants were selected on the basis of at least four independent recommendations on their erudition in this field. In the first phase 96 informants were selected for the survey. For the validation / authentication of informant, each informant was queried thrice after a defined time interval of 8 to 12 months for uses and each query was termed as an event. This information for a particular informant was tallied and mean was calculated for the three events. Care, however, was taken not to introduce hints which could affect or modify the answers. In second and third phases of field studies, information provided by 42 informants was found to be counterfeit and non significant. To get through right decision about disease, the symptoms described by the herbalists were discussed and confirmed with general physician of allopathic system of medicine. Ethno-medicinal survey of various tribal localities of Southern Rajasthan reveals 53 therapeutic usages of 75 plants for 15 body system. Qualitative ethno-medicinal data reveals that *Holarrhena antidysenterica* and *Manilkara hexandra* barks are deployed for dysentery, *Dalbergia paniculata* for diphtheria and *Albizia lebbek*, *Albizia procera*, *Dalbergia sissoo* and *Kydia calycina* for gonorrhoea. *Anthocephalus cadamba* is used to get rid off

tumors. *Cordia gharaf* bark is used to raise hemoglobin level while *Commiphora wightii* is used to reduce the stuffed body fat. Five species viz. *Aegle marmelos*, *Boswellia serrata*, *Commiphora wightii*, *Leucaena leucocephala* and *Syzygium cumini* are used to reduce high glycemic levels and three species of *Terminalia* viz- *T. arjuna*, *T. bellirica* and *T. chebula* are used for blood pressure regulation. *Bauhinia purpurea* and *Bauhinia racemosa* are deployed for throat infection or sore. Decoction of *Dichrostachys cinerea* is ingested to check nasal bleeding. *Bridelia retusa* is used to refrain from tonsillitis. Ethnically *Anogeissus sericea*, and *Erythrina indica* are used by patients of asthma. Disruption in digestive tract and many other factors contribute to mouth boils and blisters which were reported to be traditionally treated by *Mimosa hamata* and *Casearia elliptica* and *Flacourtia indica* respectively. Undefined and combined symptoms including nausea or recurrent upset stomach, abdominal bloating and pain, vomiting, indigestion and/ or loss of appetite are termed under common category as gastric problems. *Adina cordifolia* is used in abdominal pain, *Soyamida febrifuga* and *Tamarindus indica* in biliousness, *Anogeissus latifolia* in dyspepsia, *Sterculia urens* and *Tamarindus indica* in flatulence and *Anogeissus pendula* in undefined digestive disorders. *Cordia dichotoma* is used to heal rapture sphincter muscles in piles. *Acacia species* viz. *A. catechu*, *A. leucophloea* and *A. nilotica* deflates intestinal inflammation. *Holoptelea integrifolia* and *Lycium barbarum* are used in peptic ulcers. According to local therapist *Acacia senegal*, *Acacia tortilis*, *Cassia fistula*, *Ficus mollis*, *Ficus palmata* and *Ficus virens* are used to get rid of stone problems though they were unable to demarcate between kidney and gall bladder stones. *Grewia species* viz *G. abutilifolia*, *G. flavescens*, *G. oppositifolia*, *G. tenax* and *G. tiliaefolia* and *Plumbago zeylanica* are reported to lock skin eruptions. *Diospyros cordifolia*, *Diospyros melanoxyton* and *Madhuca indica* are used in psoriasis.(Table:1)

According to quantitative analysis *Oroxylum indicum* and *Madhuca indica* has maximum use value as 2.05 followed by *Gmelina arborea*

(2.03) and *Diospyros melanoxyton* (2.01) while the *Wrightia tinctoria* has low therapeutic value (0.92). The forest area located farthest from the community was less disturbed and had a greater family richness than the area adjacent to the community. *Oroxylum indicum* (99.72) and *Sterculia urens* (99.61) carry high % FL whereas *Erythrina indica* (53.57) and *Plumbago zeylanica* (55.5) the lowest. Higher % FL of these plants is an indication of their high healing potential. Relative index was found to be 7.05 (minimum) in 19 species viz. *Boswellia serrata*, *Tamarix diocia*, *Bridelia retusa*, *Securinega leucopyrus*, *Dalbergia paniculata*, *Dichrostachys cinerea*, *Anogeissus pendula*, *Ficus palmata*, *Ficus mollis*, *Mallotus philippensis*, *Cordia gharaf*, *Leucaena leucocephala*, *Moringa concanensis*, *Bauhinia racemosa*, *Acacia catechu*, *Anthocephalus cadamba*, *Mimosa hamata*, *Casearia elliptica* and *Prosopis cineraria* while it was maximum in *Oroxylum indicum* (68.68) followed by value of 67.05 in *Commiphora wightii*, *Gmelina arborea* and *Sterculia urens*. The technique of relative importance (RI) emphasizes those plants that have the greatest absolute number of uses. As such, it cannot be used to validate the argument that the importance of a given plant is associated with its multiple uses (Albuquerque, *et al.*, 2006).

Maximum RFC (0.97) was observed in *Diospyros melanoxyton* followed by *Commiphora wightii* (0.89), *Gmelina arborea* (0.87) and *Oroxylum indicum* (0.86) while minimum in *Grewia abutilifolia* (0.19) and *Grewia tiliaefolia* (0.24). This reflects the strong and long term association of inhabitants with high RFC local plants (Ahmad, *et al.*, 2014). *Oroxylum indicum* has maximum UV, % FL and RI which reveals its utmost consumption as therapeutic bark by aboriginals though its usage is confined only for general debility sand behavioral disorders associated with pregnancy, childbirth, or the puerperium due to which it has poor RCF as it does not supports multiple body systems. (Table:1)

Ailanthus excelsa, *Anogeissus latifolia*, *Commiphora wightii*, *Diospyros melanoxyton*, *Gmelina arborea*, *Holoptelea integrifolia*, *Madhuca indica*, *Oroxylum indicum*, *Sterculia urens* and *Tamarindus indica* indicate widespread usage.

Quantification through ICF for these trees reveals all informants of Bhil, Meena and Garasia tribes had no degree of agreement (ICF-0.00) on the usage of *Commiphora wightii* and only Damor tribe uses the same. Similar data was also obtained for *Madhuca indica* for which its uses were confined only in Bhils and Damors while Meena and Garasia tribe denied its uses. Usage of *Sterculia urens* was more observed in Garasia followed by Damor while Bhils preferred *Anogeissus latifolia*. Minimum ICF was observed for *Gmelina arborea* in Bhil and Meena tribe and *Holoptelea integrifolia* in Garasia and Damor tribes. 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 1) if there is a well-defined selection criterion in the community and/or if information is exchanged among informants or communities (Upadhyay, *et al.*, 2011) i.e. except *Commiphora wightii* and *Madhuca indica* there was a clear usage of *Ailanthus excelsa*, *Anogeissus latifolia*, *Diospyros melanoxylon*, *Gmelina arborea*, *Holoptelea integrifolia*, *Oroxylum indicum*, *Sterculia urens* and *Tamarindus indica* across all studied for tribes.(Table:2)

Table 1: Ethno-medicinal enumeration and Use Value (UV), Percent fidelity level (% FL), Relative index (RI) and Relative frequency citation (RFC) of tree and shrubs species of southern Rajasthan (TD-Types of disease; DC-Disease category and NoI-Number of informants)

S. No	Botanical name, Family (Local name), Herbarium Acc. No. [TD/DC] NoI	Ailment / Disorder (Disease category -ICD 11) [ICD-6, 7 and 8]	UV	% FL	RI	RFC
1.	<i>Acacia catechu</i> Willd. Mimosaceae (Khair) (BNU/03/2020/01) [1/1]23	Intestinal inflammation (13) [NIL]	1.06 ± 0.53**	90.00 ± 1.78*	7.05 ± 0.69**	0.45 ± 0.15**
2.	<i>Acacia ferruginea</i> DC. Mimosaceae (Banoli) (BNU/03/2020/02) [1/1]13	Demulcent (14) [NIL]	1.25 ± 0.90***	88.42 ± 0.10*	42.27 ± 1.20	0.4 ± 0.15**
3.	<i>Acacia leucophloea</i> Willd. Mimosaceae (Rijooa) (BNU/03/2021/29) [1/1]32	Intestinal inflammation (13) [NIL]	1.43 ± 0.53*	93.25 ± 0.68***	33.18 ± 0.83*	0.52 ± 0.13**
4.	<i>Acacia nilotica</i> L. Mimosaceae (Babul) (BNU/03/2021/30) [1/1]19	Intestinal inflammation (13) [NIL]	1.1 ± 1.33**	83.3 ± 0.19 ***	35.23 ± 1.16*	0.64 ± 0.03**
5.	<i>Acacia senegal</i> Willd. Mimosaceae (Kumat) (BNU/03/2021/31) [1/1]21	Stone problems (13) [NIL]	1.45 ± 0.75**	86.96 ± 0.94**	44.77 ± 1.35*	0.60 ± 0.15**
6.	<i>Acacia tortilis</i> Forsk. Mimosaceae (Kumatia) (BNU/03/2021/32) [1/1]26	Stone problems (13) [NIL]	1.43 ± 0.66*	84.28 ± 0.60*	37.73 ± 0.81*	0.60 ± 0.16*
7.	<i>Adina cordifolia</i> Willd. Rubiaceae (Haldu) (BNU/03/2020/03) [1/1]13	Abdominal pain (13) [NIL]	1 ± 1.55*	85.29 ± 0.66**	47.27 ± 1.55*	0.47 ± 0.15*
8.	<i>Aegle marmelos</i> Correa. Rutaceae (Bel) (BNU/03/2020/04) [2/2]31	Diabetes (05) & Dysuria (16) [NIL]	1.55 ± 0.66**	91.00 ± 0.81**	41.82 ± 1.78*	0.38 ± 0.25***
9.	<i>Ailanthus excelsa</i> Roxb. Simaroubaceae (Arru) (BNU/03/2020/05) [2/2]23	Insect bite (22) & Bone Fractures (15) [Mood disorders 6A60-	1.99 ± 2.00*	95.32 ± 0.41*	57.95 ± 1.33*	0.76 ± 0.15**

		6A8Z]				
10.	<i>Albizia lebbek</i> (L.) Benth. Mimosaceae (Siras) (BNU/03/2021/33) [1/1]25	Gonorrhoea (01) [NIL]	1.45 ± 0.45**	91.84 ± 1.60*	35.23 ± 1.33*	0.55 ± 0.10**
11.	<i>Albizia procera</i> Benth. Mimosaceae (Siras) (BNU/03/2021/34) [1/1]21	Gonorrhoea (01) [NIL]	1.48 ± 0.66***	81.34 ± 0.08***	9.55 ± 0.15***	0.63 ± 0.25**
12.	<i>Anogeissus latifolia</i> Roxb. Combretaceae (Dhavada) (BNU/03/2021/35) [3/2]31	Lactation (18), Dyspepsia(13) & Abortifacient (18) [Antistress 6B40-6B4Z]	1.96 ± 0.90**	98.06 ± 0.15*	66.14 ± 0.08	0.75 ± 0.05**
13.	<i>Anogeissus pendula</i> Edgw. Combretaceae (Dhavada) (BNU/03/2020/06) [1/1]28	Digestive disorders (13) [NIL]	1.3 ± 1.55**	76.50 ± 2.00**	7.05 ± 0.69**	0.54 ± 0.1**
14.	<i>Anogeissus sericea</i> Brand. Combretaceae (Adhanu) (BNU/03/2020/07) [1/1] 32	Asthma (12) [NIL]	1.58 ± 2.00**	78.00 ± 0.81**	9.55 ± 0.15*	0.65 ± 0.13**
15.	<i>Anthocephalus cadamba</i> Roxb. Rubiaceae (Kath) (BNU/03/2021/36) [1/1]17	Tumors (02) [NIL]	1.1 ± 0.33***	90.75 ± 1.78**	7.05 ± 0.69*	0.70 ± 0.1**
16.	<i>Bauhinia purpurea</i> L. Caesalpiniaceae (Kachnar) (BNU/03/2021/37) [1/1] 16	Throat sore (12) [NIL]	1.82 ± 0.66***	85.5 ± 1.35*	14.09 ± 0.66**	0.48 ± 0.02*
17.	<i>Bauhinia racemosa</i> Lam. Caesalpiniaceae (Kachnar) (BNU/03/2021/38) [1/1]30	Throat sore (12) [NIL]	1.87 ± 0.66**	89.89 ± 0.15***	7.05 ± 0.69***	0.39 ± 0.15***
18.	<i>Bombax ceiba</i> L. Bombacaceae (Semal) (BNU/03/2021/39) [1/1]23	Impotency (17) [NIL]	1.36 ± 0.53***	91.00 ± 1.33***	12.05 ± 1.39*	0.54 ± 0.11***
19.	<i>Boswellia serrata</i> Roxb. Burseraceae (Salar) (BNU/03/2021/40) [1/1]26	Diabetes (05) [NIL]	1.53 ± 1.00**	67.62 ± 0.13*	7.05 ± 0.69*	0.58 ± 0.15**
20.	<i>Bridelia retusa</i> L.	Tonsillitis (12) [NIL]	1.53 ± 2.13***	73.5 ± 1.00*	7.05 ± 0.69*	0.49 ± 0.21*

	Euphorbiaceae (Lampan) (BNU/03/2021/41) [1/1]19					
21.	<i>Butea monosperma</i> Lam. Fabaceae (Dhak) (BNU/03/2021/42) [1/1] 23	Undefined Skin disease (14) [NIL]	1.81 ± 0.38**	78.4 ± 0.19*	33.18 ± 1.37**	0.64 ± 0.18
22.	<i>Casearia elliptica</i> Willd. Flacourtiaceae (Mojal) (BNU/03/2020/08) [1/1]24	Mouth Blisters (13) [NIL]	1.08 ± 0.90**	92.68 ± 0.83**	7.05 ± 0.69	0.66 ± 0.50***
23.	<i>Cassia fistula</i> L. Caesalpiaceae (Amaltas) (BNU/03/2021/43) [1/1] 26	Stone problems (13) [NIL]	1.13 ± 0.38**	82.32 ± 1.05*	61.82 ± 1.05***	0.43 ± 0.15*
24.	<i>Commiphora wightii</i> Arn. Burseraceae (Gugal) (BNU/03/2021/44) [2/1]23	Diabetes (05) & Obesity (05) [Eating disorders 6B80- 6B8Z]	1.99 ± 0.33*	98.34 ± 1.87*	67.05 ± 0.69*	0.89 ± 0.03*
25.	<i>Cordia dichotoma</i> Forst. Ehretiaceae (Gunda) (BNU/03/2021/45) [1/1] 33	Piles (13) [NIL]	1.79 ± 0.38**	78.4 ± 1.33**	14.09 ± 0.66***	0.64 ± 0.18*
26.	<i>Cordia gharaf</i> Forsk. Ehretiaceae (Gunda) (BNU/03/2021/46) [1/1]24	Anemia (05) [NIL]	1.62 ± 0.84*	82.76 ± 0.81***	7.05 ± 0.69***	0.68 ± 0.15**
27.	<i>Crateva magna</i> (Lour.)DC. Capparaceae (Varta) (BNU/03/2021/47) [1/1]22	Rheumatism (15) [NIL]	1.25 ± 0.66**	73.5 ± 1.00*	9.55 ± 1.33*	0.56 ± 0.10**
28.	<i>Dalbergia paniculata</i> Roxb. Fabaceae (Talli) (BNU/03/2020/09) [1/1] 25	Diphtheria (01) [NIL]	1.67 ± 0.38***	75.46 ± 0.10***	7.05 ± 0.69*	0.58 ± 0.15*
29.	<i>Dalbergia sissoo</i> Roxb. Fabaceae (Shisham) (BNU/03/2021/48) [1/1]22	Gonorrhoea (01) [NIL]	1.67 ± 0.90***	79.38 ± 1.35*	19.09 ± 0.81***	0.46 ± 0.50*
30.	<i>Dichrostachys cinerea</i> Linn. Fabaceae (Khair) (BNU/03/2021/49) [1/1]26	Nostril hemorrhage (12) [NIL]	1.83 ± 0.66***	75.46 ± 1.25***	7.05 ± 0.69	0.43 ± 0.13*

31.	<i>Diospyros cordifolia</i> Roxb. Ebenaceae (Timru) (BNU/03/2021/50) [1/1]23	Psoriasis (14) [NIL]	1.29 ± 0.38**	76.89 ± 0.81***	28.18 ± 1.33**	0.52 ± 0.10**
32.	<i>Diospyros melanoxylon</i> Roxb. Ebenaceae (Tendu) (BNU/03/2021/51) [1/1]33	Psoriasis (14) [Anxiety 6C90-6C9Z & Stress 6C20- 6C2Z]	2.01 ± 0.37*	95.34 ± 1.55**	63.18 ± 1.67***	0.97 ± 0.67***
33.	<i>Ehretia aspera</i> Willd. Ehretiaceae (Luni) (BNU/03/2020/10) [1/1]22	Infertility (16) [NIL]	1.75 ± 0.84**	90.00 ± 1.78**	26.14 ± 0.08*	0.35 ± 0.07*
34.	<i>Ehretia laevis</i> Roxb. Ehretiaceae (Tamboli) (BNU/03/2021/52) [1/1]17	Infertility (16) [NIL]	1.92 ± 0.75***	82.32 ± 1.87***	9.55 ± 0.15*	0.68 ± 0.33**
35.	<i>Erythrina indica</i> Lam. Fabaceae (Rakta) (BNU/03/2021/53) [1/1]23	Asthma (12) [NIL]	1.46 ± 0.33*	53.57 ± 0.83***	40.91 ± 0.15***	0.45 ± 0.11*
36.	<i>Ficus mollis</i> Vahl. Moraceae (Umbio) (BNU/03/2021/54) [1/1]24	Stone problems (13) [NIL]	1.08 ± 0.34**	81.34 ± 0.13*	7.05 ± 0.69**	0.36 ± 0.30**
37.	<i>Ficus palmata</i> King. Moraceae (Kasumati) (BNU/03/2020/11) [1/1]23	Stone problems (13) [NIL]	1.50 ± 0.75*	80.36 ± 1.05*	7.05 ± 0.69**	0.36 ± 0.37*
38.	<i>Ficus virens</i> Ait. Moraceae (Umar) (BNU/03/2020/12) [1/1]17	Stone problems (13) [NIL]	1.58 ± 0.90**	83.3 ± 0.08***	37.73 ± 1.87*	0.43 ± 0.17***
39.	<i>Flacourtia indica</i> Burm. Flacourtiaceae (Kankair) (BNU/03/2021/55) [1/1]23	Mouth Blisters (13) [NIL]	1.67 ± 0.50**	88.24 ± 0.19*	14.09 ± 0.66***	0.58 ± 0.23*
40.	<i>Gmelina arborea</i> Roxb. Lamiaceae (Hawan) (BNU/03/2020/13) [2/1] 22	Arthritis(15) & Rheumatism (15) [Schizophrenia 6A20- 6A2Z]	2.03 ± 0.84**	97.52 ± 1.05***	67.05 ± 0.69*	0.87 ± 0.15*
41.	<i>Grewia abutilifolia</i> Vent. Tiliaceae (Gangestri)	Skin eruptions (14) [NIL]	1.21 ± 0.70*	82.34 ± 0.08*	14.09 ± 0.66*	0.19 ± 0.11***

	(BNU/03/2020/14) [1/1]11					
42.	<i>Grewia flavescens</i> A.Juss. Tiliaceae (Gangestri) (BNU/03/2021/56) [2/1]10	Skin eruptions (14) [NIL]	1.71 ± 0.22**	78.61 ± 0.15*	35.68 ± 1.55*	0.68 ± 0.26
43.	<i>Grewia oppositifolia</i> Roxb. Tiliaceae (Gangir) (BNU/03/2021/57) [1/1]12	Skin eruptions (14) [NIL]	1.08 ± 0.38***	98.91 ± 1.00*	21.14 ± 0.10**	0.53 ± 0.08*
44.	<i>Grewia tenax</i> Forsk. Tiliaceae (Gangechi) (BNU/03/2021/58) [1/1]24	Skin eruptions (14) [NIL]	1.76 ± 0.75**	76.44 ± 1.87*	16.59 ± 0.10**	0.68 ± 0.07*
45.	<i>Grewia tiliaefolia</i> , Vahl. Tiliaceae (Gangechi) (BNU/03/2020/15) [1/1]23	Skin eruptions (14) [NIL]	1.80 ± 0.33**	93.5 ± 0.19***	16.59 ± 0.10**	0.24 ± 0.07*
46.	<i>Holarrhena antidysenterica</i> Wall. Apocyanaceae (Kodaiya) (BNU/03/2021/59) [1/1]24	Dysentery (01) [NIL]	1.52 ± 0.33***	72.52 ± 0.83**	14.09 ± 0.66***	0.84 ± 0.18***
47.	<i>Holoptelea integrifolia</i> Roxb. Ulmaceae (Churil) (BNU/03/2021/60) [2/1]27	Mouth Blisters (13) & Peptic ulcer(13) [Hypersomnolence 7A20- 7A2Z]	2.00 ± 0.84**	95.52 ± 0.83**	66.59 ± 0.10**	0.78 ± 0.33*
48.	<i>Kydia calycina</i> Roxb. Malvaceae (Kadihakro) (BNU/03/2021/61) [1/1] 23	Gonorrhoea (01) [NIL]	1.15 ± 0.84*	81.00 ± 1.33**	21.14 ± 1.85*	0.38 ± 0.15*
49.	<i>Leucaena leucocephala</i> Lam. Mimosaceae (Halar) (BNU/03/2020/16) [1/1]33	Diabetes (05) [NIL]	1.80 ± 0.38***	83.33 ± 1.00***	7.05 ± 0.69*	0.38 ± 0.13*
50.	<i>Lycium barbarum</i> L. Solanaceae (Phor) (BNU/03/2021/62) [1/1]24	Peptic ulcer (13) [NIL]	1.00 ± 0.90**	76.44 ± 1.05***	35.23 ± 0.15**	0.65 ± 0.19*
51.	<i>Madhuca indica</i> (L.) Macbr. Sapotaceae (Mahua) (BNU/03/2020/17) [2/2] 26	Psoriasis(14) & Cirrhosis(13) [Depression 6E40-6E40Z Stress 6B40-6B4Z]	2.05 ± 0.38**	98.00 ± 1.95*	65.00 ± 0.83	0.84 ± 0.16*

52.	<i>Mallotus philippensis</i> Lam. Euphorbiaceae (Sindur) (BNU/03/2020/18) [1/1]28	Anti-worm (22) [NIL]	1.40 ± 0.66**	82.66 ± 0.13*	7.05 ± 0.69*	0.57 ± 0.03*
53.	<i>Manilkara hexandra</i> Roxb. Sapotaceae (Runkhdi) (BNU/03/2021/63) [1/1]33	Dysentery (01) [NIL]	1.87 ± 0.33**	85.46 ± 0.81***	33.18 ± 1.50*	0.46 ± 0.50**
54.	<i>Maytenus emarginatus</i> Willd. Celastraceae (Kankera) (BNU/03/2021/64) [1/1] 23	Rheumatism (15) [NIL]	1.75 ± 0.50***	80.77 ± 0.10***	25.68 ± 1.05*	0.65 ± 0.15*
55.	<i>Mimosa hamata</i> Willd. Mimosaceae (Jivar) (BNU/03/2020/19) [1/1] 23	Boils (13) [NIL]	1.00 ± 0.38***	91.67 ± 1.00***	7.05 ± 0.69**	0.53 ± 0.20*
56.	<i>Moringa concanensis</i> Nimmo. Moringaceae (Sirjana) (BNU/03/2020/20) [3/1] 24	Arthritis (15), Rheumatism (15) & Inflammation(15) [NIL]	1.00 ± 0.38**	84.21 ± 1.55*	7.05 ± 0.69**	0.84 ± 0.04*
57.	<i>Moringa oleifera</i> Lam. Moringaceae (Sirjana) (BNU/03/2021/65) [3/1]33	Arthritis (15), Rheumatism (15) & Inflammation(15) [NIL]	1.84 ± 0.90*	92.31 ± 1.05**	24.09 ± 1.33**	0.65 ± 0.19*
58.	<i>Oraxylum indicum</i> Vent. Bignoniaceae (Dasham) (BNU/03/2020/21) [1/1]23	General Debility (17) [Behavioral disorders associated with pregnancy, childbirth, or the puerperium 6E20-6E2Z]	2.05 ± 0.38**	99.72 ± 0.15*	68.68 ± 1.88*	0.86 ± 0.10***
59.	<i>Pithecellobium dulce</i> Roxb. Mimosaceae (Kikar) (BNU/03/2021/66) [1/1]20	Constipation (01) [NIL]	1.20 ± 0.66***	75.46 ± 0.08*	28.18 ± 1.33*	0.62 ± 0.05*
60.	<i>Plumbago zeylanica</i> L. Plumbaginaceae (Chitrak) (BNU/03/2020/22) [1/1]24	Skin eruptions (14) [NIL]	1.00 ± 0.33**	55.5 ± 2.05***	23.64 ± 0.81**	0.58 ± 1.33**
61.	<i>Prosopis cineraria</i> L. Mimosaceae (Sangri) (BNU/03/2021/67) [1/1]31	Rheumatism (15) [NIL]	1.99 ± 0.84***	94.3 ± 1.00***	7.05 ± 0.69***	0.37 ± 0.25**
62.	<i>Prosopis juliflora</i> DC. Mimosaceae (Khejri) (BNU/03/2021/68) [1/1] 22	Rheumatism (15) [NIL]	1.15 ± 0.38**	76.44 ± 0.13*	54.77 ± 0.19*	0.44 ± 0.18*

63.	<i>Rhus mysurensis</i> G. Don. Anacardiaceae (Dansaria) (BNU/03/2021/69) [1/1]23	Inflammation(15) [NIL]	1.08 ± 0.66*	81.29 ± 1.05***	42.27 ± 0.08*	0.51 ± 0.07*
64.	<i>Securinega leucopyrus</i> Willd. Euphorbiaceae (Jhar) (BNU/03/2021/70) [1/1]20	Jaundice (13) [NIL]	1.37 ± 0.38**	75.46 ± 2.00**	7.05 ± 0.69*	0.53 ± 0.40**
65.	<i>Sesbania grandiflora</i> Pers. Fabaceae (Vardh) (BNU/03/2020/24) [1/1]19	Constipation (01) [NIL]	1.62 ± 0.66***	71.54 ± 0.81*	40.23 ± 2.08***	0.68 ± 0.32*
66.	<i>Soyamida febrifuga</i> Roxb. Juss. Meliaceae (Rohina) (BNU/03/2020/25) [1/1]23	Biliousness (13) [NIL]	1.27 ± 0.50**	89.58 ± 1.55**	38.18 ± 0.08*	0.60 ± 0.18**
67.	<i>Sterculia urens</i> Roxb. Sterculiaceae (Kadaya) (BNU/03/2021/71) [1/1] 21	Flatulence (21) [Eating disorders 6B80- 6B8Z]	1.98 ± 0.38***	99.61 ± 0.15*	67.05 ± 0.69**	0.82 ± 0.15*
68.	<i>Syzygium cumini</i> Skeels. Myrtaceae (Jamun) (BNU/03/2020/26) [1/1]23	Diabetes (05) [NIL]	1.10 ± 0.90***	84.00 ± 0.08***	21.14 ± 0.87*	0.35 ± 0.09**
69.	<i>Tamarindus indica</i> L. Caesalpinaceae (Imli) (BNU/03/2021/72) [2/2] 23	Biliousness (13) & Flatulence (21) [Mood disorders 6A60- 6A8Z]	1.97 ± 0.33**	96.06 ± 0.10**	64.09 ± 0.66***	0.80 ± 0.15**
70.	<i>Tamarix dioica</i> L.Roxb.ex.Roth. Tamariaceae (Jhau) (BNU/03/2020/27) [1/1] 25	Kidney dysfunction (16) [NIL]	1.67 ± 0.38**	72.52 ± 0.83**	7.05 ± 0.69*	0.60 ± 0.15**
71.	<i>Tecomella undulata</i> Sm. Bignoniaceae (Rohida) (BNU/03/2021/73) [1/1] 23	Leucorrhoea (16) [NIL]	1.85 ± 0.50***	87.58 ± 0.01***	14.09 ± 0.66**	0.62 ± 0.38**
72.	<i>Terminalia arjuna</i> Roxb. Combretaceae (Arjuna) (BNU/03/2021/74) [1/1] 21	Blood Pressure regulation(11) [NIL]	1.89 ± 0.50***	87.12 ± 0.10*	45.23 ± 0.81*	0.64 ± 0.18*
73.	<i>Terminalia bellerica</i> Roxb. Combretaceae (Behada)	Blood Pressure regulation(11) [NIL]	1.84 ± 0.90***	88.23 ± 0.19***	38.18 ± 2.00***	0.66 ± 0.50*

	(BNU/03/2020/28) [1/1] 23					
74.	<i>Terminalia chebula</i> Retz. Combretaceae (Behada) (BNU/03/2021/75) [1/1] 23	Blood Pressure regulation(11) [NIL]	1.00 ± 0.50*	75.46 ± 1.33**	26.14 ± 0.10*	0.68 ± 0.15***
75.	<i>Wrightia tinctoria</i> Roxb. Apocynaceae (Khirmi) (BNU/03/2021/76) [1/1] 26	Apnea (07) [NIL]	0.92 ± 0.38**	79.5 ± 1.00**	35.23 ± 0.13***	0.61 ± 0.66***
Values are mean ± SEM and P *<0.05; **<0.01; ***<0.001						

Table 2: Comparative study of Informant consensus factor (ICF) of tree species from southern Rajasthan

Tree Species	ICF-1 (Bhil)	ICF-2 (Meena)	ICF-3 (Garasia)	ICF-4 (Damor)
<i>Ailanthus excelsa</i>	0.28 ± 0.03**	0.42 ± 0.11***	0.20 ± 0.02**	0.40 ± 0.04***
<i>Anogeissus latifolia</i>	0.41 ± 0.13**	0.53 ± 0.11***	0.36 ± 0.11**	0.40 ± 0.04***
<i>Commiphora wightii</i>	0	0	0	0.54 ± 0.11***
<i>Diospyros melanoxylon</i>	0.18 ± 0.11*	0.39 ± 0.13**	0.26 ± 0.01**	0.29 ± 0.02**
<i>Gmelina arbore</i>	0.09 ± 0.01*	0.18 ± 0.01*	0.32 ± 0.04**	0.36 ± 0.08**
<i>Holoptelea integrifolia</i>	0.25 ± 0.02**	0.18 ± 0.01*	0.08 ± 0.01*	0.16 ± 0.01*
<i>Madhuca indica</i>	0.60 ± 0.11***	0	0	0.69 ± 0.04***
<i>Oroxylum indicum</i>	0.22 ± 0.08*	0.30 ± 0.02**	0.44 ± 0.08***	0.25 ± 0.02**
<i>Sterculia urens</i>	0.31 ± 0.11**	0.40 ± 0.04***	1.00 ± 0.18*	0.50 ± 0.17***
<i>Tamarindus indica</i>	0.33 ± 0.13***	1.00 ± 0.03*	0.22 ± 0.04*	0.44 ± 0.11***
Values are mean ± SEM and P *<0.05; **<0.01; ***<0.001				

Conclusion

Ethno-medicinal survey of various tribal localities of Southern Rajasthan was carried out. Documented tree species was further quantitatively analysed for Use Value, Percent fidelity level, Relative Index, Relative frequency citation and Informant consensus factor were use to quantized data. Eight tree species were reported to be used for mental, behavioral / neuro-developmental disorders and nervous system. Though no correlation regarding application of tree species for physical, emotional or cellular stress were reported but in neurological associated maladies *Holoptelea integrifolia* is used in hypersomnolence. *Anogeissus latifolia*, *Diospyros melanoxylon* and *Madhuca indica* are used to burst stress though no specific stress was mentioned by any of the informants. *Diospyros melanoxylon* was reported to be useful in anxiety while *Madhuca indica* depletes depression. Regarding behavior disorders *Ailanthus excelsa* and *Tamarindus indica* are deployed for mood disorders. The Informant consent factor was reported less than 50 percent for *Commiphora wightii* and *Madhuca indica*.

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