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Cover Photos: Above: Tribal artifacts on display for sale in a shop at Aizwal in Mizoram ; Below-Left: Little known fruits, rhizomes and tubers being sold in a local tribal hat near Ranchi (Jharkhand); Right: Tribal artifacts on display for sale on a gift shop in Grand Canyon (USA) (Credits: Dr. Anil K. Goel)

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Quantitative analysis of ethnomedicinal plants used by tribes of Bhiloda (East), Aravalli district of Gujarat (India)

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Abstract

This ethnobotanical survey conducted from 2015 to 2019 in Bhiloda taluka, Gujarat, identified 68 medicinal plant species used by the Bhil community. Data were gathered from six traditional healers and analyzed using quantitative indices, including use value, informant consensus factor, and fidelity level. A total of 68 species were distributed across 42 plant families, with Fabaceae and Caesalpiniaceae being the most represented. Roots and leaves were the most commonly used plant parts, with extracts being the predominant drug preparation form. *Cassia auriculata* was the most widely used species. Notably, five plants such as *Abelmoschus manibot*, *Abrus precatorius*, *Calotropis procera*, *Grewia flavescens* and *Syzygium cumini* exhibited a 100% fidelity level, indicating consistent use for specific ailments. The study underscores the rich medicinal knowledge of tribal communities and calls for conservation of both plant species and traditional knowledge, while providing a foundation for future pharmacological research.

Key words: Ethnomedicinal plants, Human ailments, Traditional knowledge, Treatment

Introduction

For millennia, early human settlements, particularly in forests and near aquatic environments, have been home to a wide variety of plants with medicinal properties. As humans began to explore their natural surroundings, they learned to harness the healing potential of plants through observation and trial-and-error methods. This knowledge was passed down through generations, forming the basis of traditional healing practices known as ethnomedicine. Ethnomedicine encompasses the ways in which different culture's view, treat, or prevent diseases using locally available plants. The plants used in these practices are termed as ethnomedicinal plants, and their applications can range from curing illnesses to enhancing general well-being. As per the World Health Organization, about 60-90% of the people in some developing countries still rely on traditional medicine based largely on species of plants and animals for their primary health care (<https://iris.who.int/bitstream/handle/>). Today, the study of ethnomedicinal plants offers valuable insights into the preservation of traditional knowledge and the

potential for new pharmaceutical discoveries.

Medicinal plants have long been central to traditional healing, especially in regions with limited access to modern healthcare. Despite modern medical advancements, ethnomedicine remains cost-effective, accessible and culturally significant. In India, particularly in remote areas like Gujarat, medicinal plant use is widespread. This paper explores the role of ethnomedicinal plants in healthcare, focusing on Bhiloda taluka, Aravalli district, Gujarat, India, where these plants are integral to preventing and treating ailments. Extensive research on ethnobotany in Gujarat, especially in Sabarkantha and Aravalli districts, has documented the traditional knowledge of local communities. Previous studies (Punjani 1997; Prajapati 2002; Bhagvan 2002; Jangid 2005; Tintisara 2014; Punjani & Pandey 2015) have contributed to this body of knowledge. More recent documentation (Pandey 2011; Tintisara 2014) focuses on ethnomedicinal practices in Bhiloda. This study adds to these efforts by recording the traditional phytotherapy practices of medicine men of tribes in four villages: Bhanmer, Dhansor, Jetpur, and Rampuri.



Materials and Methods

Study Area

The study focuses on the Bhiloda (East) range in Aravalli district, Gujarat, chosen for its rich ethnobotanical diversity (Fig. 1). The region was selected based on two key factors: 1). 59.85% of the district's population is from Scheduled Tribes, with four study villages having an average tribal population of 90.45%, and 2). 37.20% of the district's area is covered by forests (Chandramouli 2014). The area features dry deciduous forests and a semi-arid climate, making it an ideal setting to explore the traditional knowledge and plant use by local tribal communities.



Fig. 1: Map of Bhiloda taluka and location of study villages of district Aravalli, Gujarat (India)
(Source: https://satellites.pro/Bhiloda_map)

Data Collection

Fieldwork was conducted between 2015-2019 to document ethno-medicinal practices used by local tribes for health maintenance and disease treatment. A combination of semi-structured interviews, guided field walks, direct observations, and sample collection was employed. Rapport was built with herbal practitioners from four villages, and six knowledgeable informants were selected as key sources of information. Key informants included Mr. Savjibhai Ninama (Bhanmer), Mr. Dhulabhai Tabiyar (Rampuri), Mr. Somaji Asari (Dhansor), Mr. Martaji Asari (Jetpur), Mr. Kishorbhai Gameti (Jetpur), and Mr. Ramanbhai Asari (Dhansor) (Table-1). Prior Informed Consent (PIC) was obtained from all participants, following CBD guidelines. Data recorded included plant uses, local names, preparation methods, dosage, and administration. Plant identification was based on the Flora

of Gujarat State (Shah 1978), and voucher specimens were deposited at the herbarium of Smt. SMP Science College, Talod. Scientific names were verified using the International Plant Name Index (www.ipni.org) and Plants of the World Online (www.powo.science.kew.org). The data were analyzed using Microsoft Excel 2019.

Quantitative analysis

Data were entered into Excel and analyzed quantitatively to determine species use-value (UV_s), family use-value (UV_f), informant consensus factor (ICF), fidelity level (FL_s) for a species and each disease category (FL_{DC}) of ICD-11, and percentage respondent knowledge (PRK). ICF and PRK were used to validate and assess the homogeneity of the data, while FL indicated the percentage of respondents using a plant for the same major purpose. The percent species (% spp) was calculated as:

$$\% \text{ spp} = \frac{(\text{No. of spp. in a family} \times 100)}{\text{Total no. of species recorded}}$$

Informant Consensus Factor (ICF)

The Informant Consensus Factor (ICF) measures the agreement among informants on the use of plant species for treating specific diseases. ICF values range from 0 to 1, with higher values indicating greater consensus. It is calculated using the formula (Trotter & Logan 1986).

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

Where 'Nur' is the total number of use-reports for a disease category and 'Nt' is the total number of plant species used for that category. A high ICF (close to 1) suggests widespread agreement on the use of specific plants, while a low ICF (close to 0) indicates varied use of species and disagreement among informants (Heinrich *et al.* 1998).

Table 1: List of informants along with their age, no. of applications, diseases treated and plants used

Name of the informant	Age (years)	Number of		
		Applications	Diseases treated	Plant species used
Savjibhai Alkhaji Ninama	68	67	33	38
Dhulabhai Lalabhai Tabiyar	79	8	7	7
Somaji Manjibhai Asari	60	15	10	9
Martaji Alkhaji Asari	60	18	10	16
Kishorbhai Devjibhai Gameti	45	11	6	10
Ramanbhai Manjibhai Asari	60	14	9	12

Species Use Value (UV_s)

Species Use Value (UV_s) is calculated to assess the relative importance of a plant species based on its reported use. The UVs was calculated using the following formula (Phillips & Gentry 1993):

$$UV_s = \frac{Nur}{Ni}$$

Where 'Nur' is the total number of use-reports for a plant species and 'Ni' is the total number of informants interviewed. High UVs indicates frequent use reports for the species, while low UVs reflect fewer citations by informants.

Family Use-Value (UV_f)

Family Use-Value (UV_f) evaluates the significance of plant families by aggregating use-reports for all species within a family. It is calculated using the formula (Phillips & Gentry 1993).

$$UV_f = \frac{Nuv}{Ni}$$

Where 'Nuv' is the total number of use-values for all species in a family and 'Ni' is the total number of species in the family. This metric reflects the relative importance of plant families based on their reported uses.

Percentage of respondent knowledge [(PRK)/ (%UV)]

Percentage of Respondent Knowledge (PRK) or Percent Use-Value index (%UV) is calculated to assess the awareness of informants about the use of a plant species for treating diseases. The formula (Friedman *et al.* 1986) is:

$$PRK = \frac{Isp}{It} \times 100$$

Where 'Isp' is the number of informants citing the plant species and 'It' is the total number of informants interviewed. A high PRK indicates widespread knowledge of a species, reflecting its importance for local healthcare needs. The Percent Use-Value index further quantifies the species' relative medicinal significance (Asiimwe *et al.* 2021).

Species Fidelity level (FL_s)

Species Fidelity Level (FLs) measures the preference of a plant species for treating a specific disease. It is calculated using the formula (Friedman *et al.* 1986):

$$FL_s = \frac{Nur}{Nt} \times 100$$

Where 'Nur' is the number of use-reports for a plant species for a specific disease and 'Nt' is the total number of use-reports for that plant species. Higher FL values indicate a strong preference for the species in treating a particular disease, suggesting its significant role in local healthcare. Low FL values indicate the species is used for multiple ailments, with less specificity for any one disease.

Disease category Fidelity level (FL_{dc})

Disease Category Fidelity Level (FL_{dc}) measures the preference of a plant species for treating a specific disease category. It is calculated using the formula (Friedman *et al.* 1986):

$$FL_{dc} = \frac{Nur}{Nt} \times 100$$

Where 'Nur' is the total number of use-reports for a plant species in a specific disease category and 'Nt' is the total number of use-reports for all plant species in that disease category. A high FL_{dc} indicates a plant's strong association with a particular disease category, signifying its popularity and importance for treating that condition. This study considered 11 disease categories adapted from the ICD-11 for Mortality and Morbidity Statistics (WHO 2022).

Reported ailments and its categories

The reported ailments of the documented medicinal plants were categorized based on the International Classification of Disease (ICD 11) version 2019. The study has listed 11 different categories of the reported ailments (Table 3). Reported ailments are given in parentheses in each disease category.

Results

A survey conducted in Bhiloda taluka, Aravalli district, Gujarat, documented 68 plant species from 63 genera and 42 families used in ethnomedicine (Table 4). The Fabaceae family had the highest representation with six species (8.8% of the total plant species), followed by Caesalpiniaceae with five species (7.4%). Four species were recorded each from Moraceae and Myrtaceae families (5.9%), and three species each from Euphorbiaceae and Malvaceae (4.4%). Seven families contributed two species each (2.9%), while 29 families had one species each (1.5%) used for ethnomedicinal purposes.

Looking to the applications of the plant species with reference to the family (Table 4), it was observed that 11 families have 5 and more than 5 applications. Of the total recorded applications, maximum 15 (11.3%) were from members of the Caesalpiniaceae family, followed by Fabaceae with 11 applications (8.3%). Three families—Bombacaceae, Malvaceae, and Simaroubaceae—each contributed 6 applications (4.5%), while six families (Aristolochiaceae, Euphorbiaceae, Liliaceae, Lorantheae, Myrtaceae, and Nyctaginaceae) each contributed 5 applications (3.8%). These 11 families accounted for 56% of the total applications, with the remaining 31 families contributing 44%.

The highest number of applications per plant was recorded for *Cassia auriculata* with 7 applications (5.3%), followed by *Ailanthus excelsa* and *Bombax ceiba*, each with 6 applications (4.5%). *Aristolochia indica*, *Asparagus racemosus*, *Boerhavia diffusa*, *Caesalpinia crista* and *Viscum articulatum* each had 5 applications (3.8%), while *Abrus precatorius* and *Annona squamosa* each had 4 applications (3%). These 10 species accounted for 39% of the total applications, while the remaining 58 species, each with fewer than 4 applications, contributed 61% (Table-4).

The plant parts used for medicinal purposes were carefully documented (Table 2). Roots were the most commonly used, with 32 applications (24%), followed by leaves (27 applications, 20%), stem bark (16 applications, 12%), and seeds (12 applications, 9%). Kernel, root bark, and shoots each had 7 applications (5%), while fruit and tender leaves each contributed 5 applications (4%). Other plant parts were less frequently used, with 1-3 applications (1-2%) each. The plant growth habit analysis showed trees as the largest group (38%, 26 species), followed by shrubs (31%, 21 species), herbs (16%, 11 species), twiners (12%, 8 species), and climbers (3%, 2 species). Of the 68 species, 56% (38 species) were wild-harvested, 25% (17 species) cultivated, and 19% (13 species) both.

The most common medicinal form was extract (63 applications, 47.4%), followed by paste (22, 16.5%), powder (14, 10.5%), decoction (10, 7.5%), and juice (8, 6%). Other forms, including vapour, raw, solution-aqueous, latex, boiling pieces, and vegetable, contributed 12%. Medicines were mainly administered orally (72%, 94 applications), with 28% (37 applications) used externally (Table-2).

Table 2: List of plant species showing habit, plant part used, Wild/Cultivated, form of drug, mode of administration and dosage & duration

S. No.	Name of the plant species (Voucher number)	Habit	Plant part	Wild/ Cultivated	Form of drug	Admin- istration mode	Dosage and Duration
1.	<i>Abelmoschus manibot</i> (L.) Medik. (VMA-01)	Sh	Rt	W/C	Ex	O	One glass (200-250 ml) of extract/ at least 2-3 days/ Once a day (morning)
2.	<i>Abrus precatorius</i> L. (VMA-02)	Tw	Lv, Rt	W/C	Ex	O	Extract used as gargle/5-7 days/once in the morning
3.	<i>Acacia nilotica</i> (L.) Willd. ex Delile (VMA-03)	Tr	Fl	W	Ex	O	One teacupful/2-3 days/ twice a day
4.	<i>Ailanthus excelsa</i> Roxb. (VMA-04)	Tr	Lv, Sb	W/C	Ex, Ps	O, E	One teacupful/Once only/ Applied topically
5.	<i>Annona squamosa</i> L. (VMA-05)	Tr	Lv, Sd	C	Ex, Ps	O, E	One teacupful/Once only/ Applied topically
6.	<i>Aristolochia indica</i> L. (VMA-06)	Tw	Rt	W	Ex, Ps	O, E	One teacupful/2-3 days/ Once only/ Apply on forehead and below nose/
7.	<i>Artocarpus heterophyllus</i> Lam. (VMA-07)	Tr	Fr	C	Veg	O	100-150 g of vegetable/ Atleast 2 weeks/ twice a day, if needed may be extended
8.	<i>Asparagus racemosus</i> Willd. (VMA-08)	Sh	Rt	W/C	Dc, Pd	O	One teacupful with milk/3-4 weeks/twice a day

S. No.	Name of the plant species (Voucher number)	Habit	Plant part	Wild/ Cultivated	Form of drug	Admin-istration mode	Dosage and Duration
9.	<i>Azadirachta indica</i> A. Juss. (VMA-09)	Tr	Sd	C	Pd	O	Two teacupful/ 15-25 days/ Twice a day
10.	<i>Azanza lampas</i> Alef. (VMA-10)	Sh	Rb	W	Ex, Ps	O, E	20-25 ml of extract given atleast for two weeks/twice a day/Applied topically
11.	<i>Balanites aegyptiaca</i> (L.) Delile (VMA-11)	Tr	Lv, Sd	W	Ex, Et	O	One teaspoonful/5-7 days/ Twice a day/
12.	<i>Bauhinia racemosa</i> Vahl (VMA-12)	Tr	Sb	W	Ex	O	One glass (200-250 ml) of extract/ atleast 2 days/ twice a day
13.	<i>Boerhavia diffusa</i> L. (VMA-13)	Hb	Rt	W	Ex	O	One teacupful/two-three days/ twice a day
14.	<i>Bombax ceiba</i> L. (VMA-14)	Tr	Rt, Rb, Sb	W	Dc, Ex	O	One glass (200-250 ml) of extract/ at least 2 days/ twice a day
15.	<i>Bryophyllum pinnatum</i> Kurz (VMA-15)	Hb	Lv	W/C	Et	O	One leaf/2-3 weeks/Once a day
16.	<i>Butea monosperma</i> (Lam.) Taub. (VMA-16)	Tr	Sb	W	Ex	O	One teacupful/Once only
17.	<i>Caesalpinia crista</i> L. (VMA-17)	Sh	Kr, Lv, Sh	W	Pd, Ex, Ju	O, E	One teacupful/5-7 days/ twice a day/4-5 drops of the juice introduced in ear tube, atleast 2 days/Once a day only
18.	<i>Calotropis procera</i> (Aiton) W.T. Aiton (VMA-18)	Sh	Rb	W	Ju, Ps	E	Apply topically over affected area/Once only
19.	<i>Camellia sinensis</i> (L.) Kuntze (VMA-19)	Sh	Lv	C	Dc	O	Half teacupful/Once a day
20.	<i>Capparis sepiaria</i> L. (VMA-20)	Sh	Rt	W	Ps	E	As per requirement/ Three days/ Twice a day
21.	<i>Carissa carandas</i> var. <i>congesta</i> (Wight) Bedd. (VMA-21)	Sh	Rt	W	Ex	O	One glass (200-250 ml) of extract/ atleast 2-3 days/ Once a day (morning)
22.	<i>Cassia auriculata</i> L. (VMA-22)	Sh	Lv	W	Ex	O	Two teacupful/ Twice a day/2-3 days
23.	<i>Cassia occidentalis</i> L. (VMA-23)	Sh	Rt	W	Ex	O	One teacupful/5-7 days/ Once only
24.	<i>Celosia argentea</i> L. (VMA-24)	Hb	Sd	W	Ex	O	Half teacupful/once only
25.	<i>Cinnamomum verum</i> J. Presl (VMA-25)	Tr	Sb	C	Vp	E	Inhale the vapour/1-2 days/ twice a day
26.	<i>Citrus limon</i> (L.) Burm.f. (VMA-26)	Sh	Fr	C	Ju	O	One glass of juice /1-2 days/once a day

S. No.	Name of the plant species (Voucher number)	Habit	Plant part	Wild/ Cultivated	Form of drug	Admin- istration mode	Dosage and Duration
27.	<i>Clerodendrum volubile</i> P. Beauv. (VMA-27)	Sh	Lv	W	Ju	E	5-10 drops of juice poured in ear tube/Once a day for 2-3 days
28.	<i>Coccinia grandis</i> (L.) Voigt (VMA-28)	Tw	Lv	C	Ju	O	2-4 drops of the juice/1-2 days/once a day
29.	<i>Cocculus hirsutus</i> (L.) Diels (VMA-29)	Tw	Lv	W	Ps, Ex	O, E	Slice of the paste put on the closed eyes/ Twice a day, atleast 4-5 days/ One teacupful/3-4 days/ Once only
30.	<i>Commiphora wightii</i> (Arn.) Bhandari (VMA-30)	Sh	Gu	W/C	Sol	O	One teacupful/ three weeks/ twice a day
31.	<i>Curcuma longa</i> L. (VMA-31)	Hb	Rh	C	Ps	E	Apply on affected area/ one week/ once a day
32.	<i>Datura innoxia</i> Mill. (VMA-32)	Hb	Fr	W	Ps	E	Smear on the affected area/ one week/ once a day (morning)
33.	<i>Dendrocalamus strictus</i> Nees (VMA-33)	Sh	Sb	W/C	Ps	E	Fill the wound with the paste/ 2-3 days/ twice a day
34.	<i>Dioscorea belophylla</i> Voigt ex Haines (VMA-34)	Tw	Rt	W	Ex	O	One teacupful/ 5-7 days/ Once only
35.	<i>Diospyros melanoxylon</i> Roxb. (VMA-35)	Tr	Kr	W	Ex	O	Half teacupful/ Two days, twice a day
36.	<i>Euphorbia nerifolia</i> L. (VMA-36)	Sh	Lt	W	La	E	Apply on affected burn area/ twice a day
37.	<i>Euphorbia tithymaloides</i> L. (VMA-37)	Sh	Lt	W/C	La	E	Latex applied topically over affected area
38.	<i>Ficus hispida</i> Roxb. ex Wall. (VMA-38)	Sh	Rt	W	Ex	O	One teacupful/ 1-2 days/ Once only
39.	<i>Ficus racemosa</i> Willd. (VMA-39)	Tr	Lt	W	Et	O	A pair of patasa with latex/ one day
40.	<i>Grewia flavescens</i> Juss. (VMA-40)	Sh	Rt	W	Ex	O	One glass (200-250 ml) of extract/ atleast 2-3 days/ Once a day (morning)
41.	<i>Hibiscus rosa-sinensis</i> L. (VMA-41)	Sh	Lv	C	Ex	O	One glass (200-250 ml) of solution/ 5-7 days/ once a day, under severe condition extend one more week
42.	<i>Holarrhena pubescens</i> Wall. ex G. Don (VMA-42)	Tr	Rt, Rb, Sb	W	Ps, Ex	O, E	Apply topically over affected area/ Once only/ One teacupful/ 3-7 days/ once a day
43.	<i>Holoptelea integrifolia</i> (Roxb.) Planch. (VMA-43)	Tr	Lv	W	Ps	E	Apply on affected area/ one week/ once a night

S. No.	Name of the plant species (Voucher number)	Habit	Plant part	Wild/ Cultivated	Form of drug	Admin- istration mode	Dosage and Duration
44.	<i>Hordeum vulgare</i> L. (VMA-44)	Hb	Gr	C	Ex	O	One glass (200-250 ml) of extract/ atleast 5-7 days/ once a day
45.	<i>Jatropha curcas</i> L. (VMA-45)	Sh	Lv, Sb	W	Ex, Ju	O, E	One teacupful/Once only/ Applied topically
46.	<i>Limonia acidissima</i> L. (VMA-46)	Tr	Lv	W	Ex	O	One glass (200-250 ml) of extract/ atleast 2-3 days/ Once a day (morning)
47.	<i>Luffa acutangula</i> (L.) Roxb. (VMA-47)	Tw	Sd	W	Ex	O	One teacupful/Once only
48.	<i>Moringa oleifera</i> Lam. (VMA-48)	Tr	Sb	W/C	Ex	O	One teacupful/2-3 days/ Once only
49.	<i>Morus alba</i> L. (VMA-49)	Tr	Lv	W/C	Pd	O	One teaspoonful with water/5-7 days/Once a day (morning)
50.	<i>Mucuna pruriens</i> (L.) DC. (VMA-50)	Tw	Rt, Sd	W	Ex, Pd	O	One teacupful/5-7 days/ twice a day
51.	<i>Piper nigrum</i> L. (VMA-51)	Tw	Fr	C	Dc, Vp	O, E	Half teacupful/Once a day/Inhale the vapour/1-2 days/ twice a day
52.	<i>Psidium guajava</i> L. (VMA-52)	Tr	Lv	C	Ex	O	Half teacupful/2-3 days/ twice a day
53.	<i>Pueraria tuberosa</i> (Roxb. ex Willd.) DC. (VMA-53)	Tr	Tu	W	Bop	O	One piece/2-3 weeks/twice a day. It can be extended for a month also, if needed.
54.	<i>Salvadora persica</i> L. (VMA-54)	Tr	Lv	W	Ps	E	Apply on affected area/one week/once a day
55.	<i>Sterculia urens</i> Roxb. (VMA-55)	Tr	Gu	W	Sol	O	One glass (200-250 ml) of solution/ 5-7 days/once a day
56.	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry (VMA-56)	Tr	Fb	C	Vp	E	Inhale the vapour/1-2 days/ twice a day
57.	<i>Syzygium cumini</i> (L.) Skeels (VMA-57)	Tr	Kr	W/C	Pd	O	Two teacupful/ 15-25 days/ Twice a day
58.	<i>Syzygium heyneanum</i> (Duthie) Wall. ex Gamble (VMA-58)	Tr	Kr, Sb	W	Pd, Ps	O, E	Two teacupful/ 15-25 days/ Twice a day
59.	<i>Tamarindus indica</i> L. (VMA-59)	Tr	Fbf	W	Ps	E	Apply topically over affected area/Once only
60.	<i>Tectona grandis</i> L.f. (VMA-60)	Tr	Kr, Sd	W	Ex, Ps	O, E	Fill the wound with the paste/2-3 days/twice a day/Apply on affected area/one week/once a day

S. No.	Name of the plant species (Voucher number)	Habit	Plant part	Wild/ Cultivated	Form of drug	Admin- istration mode	Dosage and Duration
61.	<i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thomson (VMA-61)	Tr	Phrt, Rt	W/C	Ex	O	One teacupful/5-7 days/ Once only
62.	<i>Trachyspermum ammi</i> Sprague (VMA-62)	Hb	Sd	C	Dc, Vp	O, E	Half teacupful/Once a day/ Inhale the vapour/1-2 days/ twice a day
63.	<i>Tridax procumbens</i> L. (VMA-63)	Hb	Lv, Sh	W	Ju, Ex	O, E	Apply topically over affected area/Once only/ One teacupful/5-7 days/ twice a day
64.	<i>Trigonella foenum-graecum</i> L. (VMA-64)	Hb	Sd	C	Pd	O	Two teacupful/ 15-25 days/ Twice a day
65.	<i>Vigna mungo</i> (L.) Hepper (VMA-65)	Tr	Sd	C	Vp	E	Inhale the vapour/1-2 days/ twice a day
66.	<i>Viscum articulatum</i> Burm.f. (VMA-66)	Hb	Sh	W	Dc, Ps	O, E	Apply topically over affected area/one week atleast/ Once a day/One teacupful/5-7 days/Once only
67.	<i>Zingiber officinale</i> Roscoe (VMA-67)	Hb	Rh	C	Dc, Vp	O, E	Half teacupful/Once a day/ Inhale the vapour/1-2 days/ twice a day
68.	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn. (VMA-68)	Sh	Lv, Rt	W/C	Ex	O	One teacupful/3-4 days/ Once only
Habit: Hb: Herb, Sh: Shrub, Tr: Tree, Tw: Twiner. Plant part(s): Fb: Flower buds, Fl: Flowers, Fbf: Fruit bark fibres, Fr: Fruits, Gr: Grains, Gu: Gum, Kr: Kernel, Lt: Latex, Lv: Leaves, Ph Rt: Photosynthetic root, Rh: Rhizome, Rb: Root bark, Rt: Root, Sd: Seeds, Sh: Shoot, Sb: Stem bark, Tu: Tuber. C=Cultivated, W=Wild. Form of drug: Bop: Boiled part, Dc: Decoction, Et: Eaten, Ex: Extract, Ju: Juice, La: Latex, Pd: Powder, Ps: Paste, Sol: Solution, Veg: Vegetable, Vp: Vapour. Mode of administration: E: External, O: Oral.							

Out of 133 applications for 47 ailments, the top five diseases with more than five applications were leucorrhea (13, 9.8%), diabetes (11, 8.3%), cough (10, 7.5%), wounds (9, 6.8%), and snake bite (7, 5.3%). The study categorized 11 disease types per ICD-11, with six showing more than 10 (10%) applications. The most frequent category was diseases of the genitourinary system (34 applications, 25.6%), followed by injury, poisoning or certain other consequences of external causes (20, 15%), diseases of digestive system (17, 12.8%), symptoms, signs or clinical findings, not elsewhere classified (16, 12%), certain infectious and parasitic diseases (15, 11.3%), and endocrine, nutritional and metabolic diseases (14, 10.5%). The remaining five categories accounted for 17 applications (12.8%) (Table-3).

Informant consensus factor (ICF)

The Informant Consensus Factor (ICF) was calculated to assess the homogeneity among informants for plant species used in each ailment category. ICF values ranged from 0.14 to 0.50 (Table 3). The highest ICF value (0.50) was observed for ICD-11 category 2 (Neoplasms), while the lowest (0.14) was for category 1 (Certain infectious and parasitic diseases). No ICF values were calculated for category 8 (Diseases of the nervous system), as only one unique report (UR) was recorded, and for categories 12 and 14, ICF was not determined due to a lack of consensus—each informant cited a different plant species for these categories.

Table 3: Diseases category Fidelity level (FL_{dc}) and informant consensus factor (ICF) to identify the most frequently used species in each disease category of ICD 11

S. No. (ICD 11)	Disease category as per ICD 11 (Diseases included in the category)	No. of use-reports	No. of plant species used	ICF	Most frequently used species in disease category (No. of plant-use of the species)	FL_{dc} (%) in disease category
1.	Certain infectious and parasitic diseases (Ascariasis, Conjunctivitis, Diarrhoea, Guinea worm, Mumps, Rabies, Tetanus, Tuberculosis, Typhoid)	15	13	0.14	<i>Viscum articulatum</i> (3)	20
2.	Neoplasms (Tumour Cancer)	3	2	0.50	<i>Azanza lampas</i> (2)	66.7
5.	Endocrine, nutritional and metabolic diseases (Diabetes, Obesity, Weakness physical)	14	10	0.31	<i>Asparagus racemosus</i> (2), <i>Bombax ceiba</i> (2), <i>Caesalpinia crista</i> (2) & <i>Syzygium cumini</i> (2)	14.3 each
8.	Diseases of the nervous system (Paralysis)	1	1	0.00	-	-
12.	Diseases of the respiratory system (Asthma, Emphysema)	2	2	0.00	-	-
13	Diseases of digestive system (Acidity, Diarrhoea, Dyspepsis, Hematemesis, Piles, Stomach ache after delivery, Ulcer in mouth)	17	10	0.44	<i>Abrus precatorius</i> (4) & <i>Bombax ceiba</i> (2)	23.5 & 11.8
14.	Diseases of the skin (Boil, Burns, Eczema, White patches)	4	4	0.00	-	-
15.	Diseases of the Musculo-skeletal system or connective tissue (Inflammation, Rheumatism)	7	6	0.17	<i>Viscum articulatum</i> (2)	28.6
16.	Diseases of the genitourinary system (Amenorrhoea, Dysuria, Infertility in male, Leucorrhoea, Menorrhagia, Menorrhoea, Oligomenorrhoea, Retention of urine, Sexual dysfunction, Stone)	34	27	0.21	<i>Mucuna pruriens</i> (3), <i>Abelmoschus manihot</i> (2), <i>Asparagus racemosus</i> (2) & <i>Grewia flavescens</i> (2)	8.8 and remaining three 5.9 each
21.	Symptoms, signs or clinical findings, not elsewhere classified (Abdominal pain, Cough, Fever, Toothache)	16	13	0.20	<i>Aristolochia indica</i> (3) & <i>Cassia auriculata</i> (2)	18.8 & 12.5
22.	Injury, poisoning or certain other consequences of external causes (Lice, Scorpion bite, Snake bite, Wound)	20	14	0.32	<i>Ailanthus excelsa</i> (4), <i>Calotropis procera</i> (2) & <i>Jatropha curcas</i> (2)	20 and remaining two 10 each

Disease category Fidelity level (FL_{DC})

Azanza lampas had the highest FL_{DC} (66.7) for neoplasms, indicating its significant role in treating cancer. It was followed by *Viscum articulatum* (28.6) for musculoskeletal diseases, *Abrus precatorius* (23.5) for digestive disorders, and *Viscum articulatum* and *Ailanthus excelsa* (20 each) for infectious diseases and injuries. Fidelity levels for other species ranged from 5.9% to 18.8%, including *Abelmoschus manibot* (5.9), *Aristolochia indica* (18.8), *Asparagus racemosus* (14.3 & 5.9), *Bombax ceiba* (14.3 & 11.8), *Caesalpinia crista* (14.3), *Calotropis procera* (10), *Cassia auriculata* (12.5), *Grewia flavescens* (5.9), *Jatropha curcas* (10), *Mucuna pruriens* (8.8) and, *Syzygium cumini* (14.3) (Table-3).

Species Use-value (UV_s)

As shown in Table-4, the use-value (UV_s) of each plant species was calculated to assess their commonness in use. Ten species had a UV greater than 0.50, including *Cassia auriculata* (1.17) and *Ailanthus excelsa* and *Bombax ceiba* (each 1.00). Other notable species with a UV of 0.83 include

Aristolochia indica, *Asparagus racemosus* and *Boerhavia diffusa*, while *Abrus precatorius* and *Annona squamosa* had a UV of 0.67.

Family Use-Value (UV_F)

The plant family importance was determined by calculating use value frequency (UV_F) for each species within a family (Table-4). UV_F values ranged from 0.17 to 1.00. Bombacaceae and Simaroubaceae had the highest UV_F (1.00), followed by Aristolochiaceae, Liliaceae, Loranthaceae, and Nyctaginaceae (0.83). Other notable families included Annonaceae (0.67) and Caesalpiniaceae (0.50), while the remaining 34 families had UV_F values below 0.50.

Percentage of respondent knowledge (PRK)

In this study, the plant species *Bombax ceiba* (66.7% PRK), *Ailanthus excelsa*, *Caesalpinia crista* and *Tectona grandis* (each with 50.0% PRK) exhibited the highest respondent knowledge, highlighting their significance for local healthcare. The remaining 13 and 51 plant species had PRK values of 33.3% and 16.7%, respectively (Table 4).

Table 4: List of recorded ethnomedicinal plants and their number of applications (Appl.), species (spp), percent species (% spp), use values of family (UV_F), species use-reports (URs), species use values (UV_s), diseases treated categories as per ICD 11, URs per disease category (URdc), Percentage of respondent knowledge (PRK) and Species Fidelity level [FL_s (%)] values

S. No.	Scientific name of the species/ local name	No. of Appl.	No. of spp	% spp	UV _F	URs	UV _s	Diseases treated categorized as per ICD 11	URdc	PRK	FLs %	References
1.	Amaranthaceae	1	1	1.5	0.17							
1.	<i>Celosia argentea</i> L. 'Garko'					1	0.17	16: Retention of urine	1	16.7	-	Pandey 2011; Puri 1983
2.	Annonaceae	4	1	1.5	0.67							
2.	<i>Annona squamosa</i> L. 'Sitafal'					4	0.67	1: Tetanus	1	33.3	-	Tintisara 2014
								16: Menorrhoea	1		-	
								22: Lice	1		-	Pandey 2011; Murlidhar & Pullaiah 2001 & Panda & Padhy 2008
								22:Wound	1		-	
3.	Apiaceae	2	1	1.5	0.33							
3.	<i>Trachyspermum ammi</i> Sprague 'Ajmo'					2	0.33	16: Amenorrhoea	1	16.7	-	
								21: Cough	1		-	Pandey 2011
4.	Apocynaceae	3	2	2.9	0.25							
4.	<i>Carissa carandas</i> var. <i>congesta</i> (Wight) Bedd. 'Kamdi'					1	0.17	16: Leucorrhoea	1	16.7	-	

S. No.	Scientific name of the species/ local name	No. of Appl.	No. of spp	% spp	UVf	URs	UVs	Diseases treated categorized as per ICD 11	URdc	PRK	FLs %	References
5.	<i>Holarrhena pubescens</i> Wall. ex G. Don 'Kado'					2	0.33	22: Snake bite	1	33.3	-	
								21: Cough	1		-	
5.	Aristolochiaceae	5	1	1.5	0.83							
6.	<i>Aristolochia indica</i> L. 'Vasar safed'					5	0.83	12: Emphysema	1	33.3	-	
								15: Rheumatism	1		-	
								21: Cough	3		60.00	Jain <i>et al.</i> .2009
6.	Asclepiadaceae	2	1	1.5	0.33							
7.	<i>Calotropis procera</i> (Aiton) W.T. Aiton 'Aakdo'					2	0.33	22: Scorpion bite	2	33.3	100.00	Tintisara 2014; Jeevan Ram <i>et al.</i> 2002
7.	Asteraceae	2	1	1.5	0.33							
8.	<i>Tridax procumbens</i> L. 'Khariyu'					2	0.33	16: Stone	1	16.7	-	Tintisara 2014
								22: Wound	1		-	Pandey 2011
8.	Balanitaceae	2	1	1.5	0.33							
9.	<i>Balanites aegyptiaca</i> (L.) Delile 'Hingoriyo'					2	0.33	1: Rabies	1	16.7	-	
								5: Diabetes	1		-	
9.	Bombacaceae	6	1	1.5	1.00							
10.	<i>Bombax ceiba</i> L. 'Shibel'					6	1.00	5: Diabetes	2	66.7	33.33	Tintisara 2014; Jain <i>et al.</i> 2009
								13: Diarrhoea	2		33.33	Pandey 2011
								13: Dyspepsia	1		-	
								16: Leucorrhoea	1		-	Tintisara 2014
10.	Burseraceae	1	1	1.5	0.17							
11.	<i>Commiphora wightii</i> (Arn.) Bhandari 'Kali guggal'					1	0.17	2: Tumour	1	16.7	-	
11.	Caesalpiniaceae	15	5	7.4	0.5							
12.	<i>Bauhinia racemosa</i> Vahl 'Shetri'					1	0.17	1: Diarrhoea	1	16.7	-	
13.	<i>Caesalpinia crista</i> L. 'Karkash'					5	0.83	13: Diabetes	2	50.0	40.00	Pandey 2011
								13: Acidity	1		-	Tintisara 2014
								16: Leucorrhoea	1		-	
								21: Toothache	1		-	
14.	<i>Cassia auriculata</i> L. 'Aaval'					7	1.17	1: Tetanus	1	33.3	-	
								13: Acidity	1		-	
								13: Stomach ache after delivery	1		-	
								16: Menorrhagia	1		-	
								21: Abdominal pain	2		28.57	Pandey 2011; Tintisara 2014
								22: Wound	1		-	

S. No.	Scientific name of the species/ local name	No. of Appl.	No. of spp	% spp	UVf	URs	UVs	Diseases treated categorized as per ICD 11	URdc	PRK	FLs %	References
15.	<i>Cassia occidentalis</i> L. 'Malvi puvad'					1	0.17	16: Oligomenorrhea	1	16.7	-	
16.	<i>Tamarindus indica</i> L. 'Aamli khati'					1	0.17	22: Scorpion bite	1	16.7	-	Tintisara 2014; Pandey & Rout 2006; Jeevan Ram <i>et al.</i> 2002 & Pawar & Patil 2004
12.	Capparaceae	1	1	1.5	0.17							
17.	<i>Capparis sepiaria</i> L. 'Kanthar'					1	0.17	1: Mumps	1	16.7	-	
13.	Crassulaceae	1	1	1.5	0.17							
18.	<i>Bryophyllum pinnatum</i> Kurz 'Panfuti'					1	0.17	16: Stone	1	16.7	-	
14.	Cucurbitaceae	2	2	2.9	0.17							
19.	<i>Coccinia grandis</i> (L.) Voigt 'Ghilodi'					1	0.17	12: Asthma	1	16.7	-	
20.	<i>Luffa acutangula</i> (L.) Roxb. 'Kukarpada'					1	0.17	22: Snake bite	1	16.7	-	
15.	Dioscoreaceae	1	1	1.5	0.17							
21.	<i>Dioscorea belophylla</i> Voigt 'Godavel'					1	0.17	XIV: Menorrhagia	1	16.7	-	
16.	Ebenaceae	1	1	1.5	0.17							
22.	<i>Diospyros melanoxylon</i> Roxb. 'Timru'					1	0.17	1: Ascariasis	1	16.7	-	
17.	Euphorbiaceae	5	3	4.4	0.28							
23.	<i>Euphorbia nerifolia</i> L. 'Vad-Thor'					1	0.17	14: Burns	1	16.7	-	
24.	<i>Euphorbia tithymaloides</i> L. 'Thor'					1	0.17	22: Snake bite	1	16.7	-	
25.	<i>Jatropha curcas</i> L. 'Ratanjot'					3	0.50	1: Rabies	1	33.3	-	Pandey 2011
								22: Wound	2		66.67	
18.	Fabaceae	11	6	8.8	0.31							
26.	<i>Abrus precatorius</i> L. 'Sarmoli'					4	0.67	13: Ulcer in mouth	4	16.7	100.00	Tintisara 2014; Gill and Nyawuame 1994; Mitaliya 2002; Bhagya & Sridhar 2009 & Jadhav 2009
27.	<i>Butea monosperma</i> (Lam.) Taub. 'Khakhro'					1	0.17	13: Diarrhoea	1	16.7	-	
28.	<i>Mucuna pruriens</i> (L.) DC. 'Kuvech'					3	0.50	16: Infertility in male	1	33.3	-	
								16: Leucorrhoea	2		66.67	
29.	<i>Pueraria tuberosa</i> (Roxb. ex Willd.) DC. 'Patal kolu'					1	0.17	5: Obesity	1	16.7	-	

S. No.	Scientific name of the species/ local name	No. of Appl.	No. of spp	% spp	UVf	URs	UVs	Diseases treated categorized as per ICD 11	URdc	PRK	FLs %	References
30.	<i>Trigonella foenum-graecum</i> L. ‘Methi’					1	0.17	5: Diabetes	1	16.7	-	
31.	<i>Vigna mungo</i> (L.) Hep-per ‘Udad’					1	0.17	21: Cough	1	16.7	-	
19.	Lauraceae	1	1	1.5	0.17							
32.	<i>Cinnamomum verum</i> J. Presl ‘Taj’					1	0.17	21: Cough	1	16.7	-	
20.	Liliaceae	5	1	1.5	0.83							
33.	<i>Asparagus racemosus</i> Willd. ‘Shatavari’					5	0.83	5: Diabetes	1	16.7	-	Pandey 2011, & Tintisara 2014
								5: Weakness physical	1		-	
								8: Paralysis	1		-	
								16: Leucor-rhoea	1		-	Tintisara 2014, Mitaliya 2002, Trivedi 2002, & Pandey & Rout 2006
								16: Sexual dysfunction	1		-	
21.	Loranthaceae	5	1	1.5	0.83							
34.	<i>Viscum articulatum</i> Burm.f. ‘Timbarvano borikho’					5	0.83	1: Tuberculosis	3	16.7	60.00	Tintisara 2014
								15: Rheuma-tism	2		40.00	
22.	Malvaceae	6	3	4.4	0.33							
35.	<i>Abelmoschus manibot</i> (L.) Medik. ‘Jangli bhindo’					2	0.33	16: Leucor-rhoea	2	33.3	100.00	
36.	<i>Azanza lampas</i> Alef. ‘Jangli kapas’					3	0.50	2: Tumour	2	16.7	66.67	Tintisara 2014; Jain & Goel 2005
								22: Wound	1		-	
37.	<i>Hibiscus rosa-sinensis</i> L. ‘Jasud’					1	0.17	13: Piles	1	16.7	-	Tintisara 2014; Barukial & Sharma 2011
23.	Meliaceae	1	1	1.5	0.17							
38.	<i>Azadirachta indica</i> A. Juss. ‘Limdo’					1	0.17	5: Diabetes	1	16.7	-	
24.	Menispermaceae	4	2	2.9	0.33							
39.	<i>Cocculus hirsutus</i> (L.) Diels ‘Thikri’					2	0.33	1: Conjunctivitis	1	16.7	-	
								1: Hematem-esis	1		-	
40.	<i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thomson ‘Adhdhar muliyu’					2	0.33	16: Amenor-rhea	1	33.3	-	Tintisara 2014
								21: Fever	1		-	Pandey 2011; Chauhan & Pillai 2003; Gupta & Shaw 2009; Kadavul & Dixit 2009, Mahajan 2007; Patil & Bhaskar 2006

S. No.	Scientific name of the species/ local name	No. of Appl.	No. of spp	% spp	UVf	URs	UVs	Diseases treated categorized as per ICD 11	URdc	PRK	FLs %	References
25.	Mimosaceae	1	1	1.5	0.17							
41.	<i>Acacia nilotica</i> (L.) Willd. ex Delile 'Deshi baval'					1	0.17	1: Typhoid	1	16.7	-	
26.	Moraceae	4	4	5.9	0.17							
42.	<i>Artocarpus heterophyllus</i> Lam. 'Fanas'					1	0.17	5: Obesity	1	16.7	-	
43.	<i>Ficus hispida</i> Roxb. ex Wall. 'Katabari'					1	0.17	1: Rabies	1	6.7	-	
44.	<i>Ficus racemosa</i> Willd. 'Umbari'					1	0.17	16: Stone	1	16.7	-	
45.	<i>Morus alba</i> L. 'Shetur'					1	0.17	16: Leucorrhoea	1	16.7	-	
27.	Moringaceae	1	1	1.5	0.17							
46.	<i>Moringa oleifera</i> Lam. 'Sargavo'					1	0.17	14: Boil	1	16.7	-	
28.	Myrtaceae	5	4	5.9	0.21							
47.	<i>Psidium guajava</i> L. 'Jamfal'					1	0.17	13: Diarrhoea	1	16.7	-	
48.	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry 'Laving'					1	0.17	21: Cough	1	16.7	-	
49.	<i>Syzygium cumini</i> (L.) Skeels 'Jambu'					2	0.33	5: Diabetes	2	33.3	100.00	
50.	<i>Syzygium heyneanum</i> (Duthie) Wall. ex Gamble 'Jal-jambu'					1	0.17	5: Diabetes	1	16.7	-	
29.	Nyctaginaceae	5	1	1.5	0.83							
51.	<i>Boerhavia diffusa</i> L. 'Bhoikhataadi'					5	0.83	1: Tetanus	1	16.7	-	Tintisara 2014
								13: Stomach ache after delivery	1		-	
								16: Menorrhoea	1		-	Wilson <i>et al.</i> 2007
								22: Wound	1		-	
								21: Abdominal pain	1		-	
30.	Piperaceae	2	1	1.5	0.33							
52.	<i>Piper nigrum</i> L. 'Kalla-mari'					2	0.33	16: Amenorrhoea	1	16.7	-	Silja <i>et al.</i> 2008
								21: Cough	1		-	Pandey 2011
31.	Poaceae	2	2	2.9	0.17							
53.	<i>Dendrocalamus strictus</i> Nees 'Vans'					1	0.17	16: Wound	1	16.7	-	
54.	<i>Hordeum vulgare</i> L. 'Jav'					1	0.17	16: Stone	1	16.7	-	
32.	Rhamnaceae	2	1	1.5	0.33							
55.	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn. 'Bordi'					2	0.33	13: Acidity	1	33.3	-	
								13: Hematemesis	1		-	

S. No.	Scientific name of the species/ local name	No. of Appl.	No. of spp	% spp	UVf	URs	UVs	Diseases treated categorized as per ICD 11	URdc	PRK	FLs %	References
33.	Rutaceae	3	2	2.9	0.25							
56.	<i>Citrus limon</i> (L.) Burm.f. 'Limbu'					1	0.17	16: Stone	1	16.7	-	
57.	<i>Limonia acidissima</i> L. 'Kothi'					2	0.33	16: Dysuria	1	33.3	-	
								16: Leucorrhoea	1		-	Bhogaonkar & Kadam 2006
34.	Salvadoraceae	1	1	1.5	0.17							
58.	<i>Salvadora persica</i> L. 'Vagdo' / 'Piludi'					1	0.17	15: Inflammation	1	16.7	-	Bhatt <i>et al.</i> 2002
35.	Simaroubaceae	6	1	1.5	1.00							
59.	<i>Ailanthus excelsa</i> Roxb. 'Arduso'					6	1.00	1: Guinea worm	1	50.0	-	
								15: Inflammation	1		-	
								22: Snake bite	4		66.67	Trivedi 2002
36.	Solanaceae	1	1	1.5	0.17							
60.	<i>Datura innoxia</i> Mill. 'Dhaturo'					1	0.17	14: Eczema	1	16.7	-	
37.	Sterculiaceae	2	1	1.5	0.33							
61.	<i>Sterculia urens</i> Roxb. 'Kadu'					2	0.33	16: Leucorrhoea	1	16.7	-	
								16: Sexual dysfunction	1		-	
38.	Theaceae	1	1	1.5	0.17							
62.	<i>Camellia sinensis</i> (L.) Kuntze 'Cha'					1	0.17	16: Amenorrhea	1	16.7	-	
39.	Tiliaceae	2	1	1.5	0.33							
63.	<i>Grewia flavescens</i> Juss. 'Kishki'					2	0.33	16: Leucorrhoea	2	33.3	100.00	
40.	Ulmaceae	1	1	1.5	0.17							
64.	<i>Holoptelea integrifolia</i> (Roxb.) Planch. 'Kajaro' / 'Kajari'					1	0.17	14: White patches/ Karodiya	1	16.7	-	
41.	Verbenaceae	4	2	2.9	0.25							
65.	<i>Clerodendrum volubile</i> P. Beauv. 'Arani'					1	0.17	21: Toothache	1	16.7	-	
66.	<i>Tectona grandis</i> L.f. 'Sag'					3	0.50	15: Inflammation	1	50.0	-	
								16: Retention of urine	1		-	
								22: Wound	1		-	
42.	Zingiberaceae	3	2	2.9	0.25							
67.	<i>Curcuma longa</i> L. 'Hal-dar'					1	0.17	15: Inflammation	1	16.7	-	Jagtap <i>et al.</i> 2008
68.	<i>Zingiber officinale</i> Roscoe 'Aadu'					2	0.33	16: Amenorrhea	1	16.7	-	
								21: Cough	1		-	

Species Fidelity level (FL_s)

The highest fidelity level (FL_s 100) was recorded for five species: *Abelmoschus manihot* (leucorrhea), *Abrus precatorius* (ulcer in mouth), *Calotropis procera* (scorpion bite & leucorrhea), *Grewia flavescens* (leucorrhoea) and *Syzygium cumini* (diabetes). The fidelity levels for the remaining nine species ranged from 28.57% to 66.67% (Table 4).

Discussion

It is observed that older traditional medicinal practitioners were more recognized and possessed extensive knowledge about medicinal plants. In this study, 67% of informants were aged 45–60 years, while 33% were between 61 and 80 years (Table 1). All six key informants, selected for their prominence as traditional healers, were male, highlighting male dominance in the practice. The findings indicate that older generations possess more knowledge of medicinal plants than younger ones. Key plant families with the highest number of medicinal species were Fabaceae (6 species, 8.8%), Caesalpiniaceae (5 species, 7.4%), and Moraceae (4 species, 5.9%). Wild plants contributed 56% of medicinal species. Roots and leaves were the most used parts (44%), and extraction was the dominant preparation method (47.4%). Oral administration (71.8%) was preferred. Neoplasms had the highest Informant Consensus Factor (ICF = 0.50), followed by digestive system diseases (ICF = 0.44). Other disease clusters had lower ICF values.

Conclusion

This paper highlights the continued prevalence of traditional medicinal plant use in the study area and emphasizes the need to document ethnomedicinal knowledge before it is lost. Ethnomedicine offers valuable insights into sustainable healthcare, especially in remote forest communities. These indices identified plant species with significant potential for pharmacological studies and drug development. The study highlighted a diverse range of species used for treating various illnesses. Further pharmacological research on plants with greater than 0.50 UV such as, *Abrus precatorius*, *Ailanthus excelsa*, *Annona squamosa*, *Aristolochia indica*, *Asparagus racemosus*, *Boerhavia diffusa*, *Bombax ceiba* and *Cassia auriculata* and plants with highest (100) fidelity levels such as *Abelmoschus manihot*, *Abrus precatorius*, *Calotropis procera*, *Grewia flavescens* and *Syzygium cumini* is essential to validate their therapeutic effectiveness. Isolating and characterizing active compounds could also uncover new drug candidates.

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Conflict of Interest

The authors declare no conflict of interest.

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Ethnomedicinal documentation of anti-diarrhoeal plant species from lateritic part of West Bengal (India)

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Abstract

Documentation of traditional knowledge through ethnobotanical studies is important for conservation and sustainable utilization of phytoresources and its associated herbal knowledge. Diarrhoeal diseases are the second largest cause of child morbidity in rural India making the exploration of traditional phytotherapies essential. In this context, the present study aims to record the folk phytotherapies practiced to cure diarrhoeal symptoms among the tribal people of the lateritic part of West Bengal. Ethnomedicinal data were collected through semi-structured interviews with 29 informants, leading to documentation of 25 anti-diarrhoeal plant species. These species were used to prepare 9 monoherbal and 8 polyherbal formulations for treating diarrhoeal diseases. Notably, bark emerged as the most frequently used plant part in these remedies. Among the 25 documented species, the anti-diarrhoeal activity of four plants viz. *Adiantum lunulatum*, *Diplocyclos palmatus*, *Lygodium flexuosum*, and *Saccharum officinarum* has not been scientifically investigated before. The lateritic zone of West Bengal, India is found an ethnobotanical treasure trove affluent with folk therapeutic knowledge and medicinal plants diversity that can serve as a model for low-cost health care against diarrhoea.

Key words: Anti-diarrhoeal plants, Traditional knowledge, Lateritic zone of West Bengal

Introduction

The study of phytoresources and associated ethnobotanical traditions has played a pivotal role in the discovery of novel natural products including modern medicines. The vast potential of medicinal plant species used in different ethnic cultures has sparked widespread interest among the researchers throughout the world fuelling a deeper exploration of diverse ethnomedical systems (Subba *et al.* 2023). This approach is deeply ingrained in the cultural heritage and traditional knowledge of indigenous communities, shaped by their beliefs and experiences.

Diarrhoea is a life-threatening disease associated with the risk of severe dehydration, leading to organ damage, and even death if untreated, especially in vulnerable populations like young children and immune suppressed adults. This disease manifests in three clinical forms: acute watery diarrhoea that lasts for hours to days, acute bloody diarrhoea known as

dysentery, and persistent diarrhoea that lasts for 14 days or longer. Diarrhoeal infections are caused by bacterial (*Escherichia coli*, *Salmonella* spp., *Shigella* spp., *Campylobacter* spp.), viral (rotavirus, norovirus, adenovirus, astrovirus), and parasitic (*Cryptosporidium* spp., *Giardia intestinalis*, *Entamoeba histolytica* and *Entamoeba moshkovskii*) pathogens. Among them, rotavirus and *E. coli* are the most prevalent across all age groups. Parasitic infections are more common in children aged 3–5 years, while bacterial infections, particularly *E. coli*, *Salmonella* spp., and *Shigella*, spp. are frequently observed in both children and adult persons (Rawat *et al.* 2017). Antibiotics like Ciprofloxacin, Metronidazole, Levofloxacin, and many more are commonly used to treat diarrhoea, but the emergence of antibiotic-resistant pathogens has significantly reduced the effectiveness of antibiotic-dependent treatments. This alarming situation underscores the urgent need for alternative prevention and treatment strategies. The plant-sourced drug discovery is found the most effective strategy for com-



bating varied range of disease-causing microbes and antibiotic-resistant pathogenic strains. For this genuine concern, scientists continue to evaluate meticulously the vast stock of medicinal plants used in different traditional systems of medicine including ethnic people's medicine systems. Fortunately, India possesses a rich repository of medicinal plants with anti-diarrheal attributes. A review of literature reveals that 419 plant species have been traditionally used to combat diarrhoea and enteric diseases (Kirtikar & Basu 1935; Chopra *et al.* 1956; Pal & Jain 1998; Paria 2005).

In this context, the present investigation has been undertaken as a part of extensive ethnobotanical studies conducted in the lateritic region of West Bengal, India to document the medicinal plants used in treatment of diarrhoeal diseases. This lateritic belt in West Bengal is endowed with a rich repository of medicinal plants distributed in the forests covering an extensive area of 2706.53 Km² that embodies 12.28 % of its total geographical area. The recorded forest area in the laterite zone comprises 30.30 Km² of Reserved Forest, 2514.85 Km² of Protected Forest, and 161.38 Km² of Unclassed State Forest. The forest vegetation of the region is dry deciduous type with 'Sal' (*Shorea robusta* Gaertn.f.) as a dominant tree associated with some other tree plants such as *Buchanania lanzan* Spreng., *Madhuca longifolia* (Koenig) Macbride, *Butea monosperma* (Lamk.) Taub., *Cochlospermum religiosum* (L.) Alston., *Pterocarpus marsupium* Roxb., etc. Total population of this geographical region is 1,44,49,070 which is 15.81% of the total population of West Bengal (Census 2011). The rural populations in this region continue to rely on traditional treatment methods, with their lives deeply intertwined with the abundant plant resources that sustain them. These plant resources serve as a vital source of varied range of ethnomedicines used by the region's indigenous people for their primary healthcare.

Extensive ethnobotanical research has been conducted earlier by many researchers which reflect the rich tradition of herbal knowledge and its related phyto-diversity of this vast lateritic tract of West Bengal (Acharya & Mukherjee 2010; Pradhan & Rahaman 2011; Bouri & Mukherjee 2012; Das & Rahaman 2014; Mandal & Rahaman 2014). But documentation of phytotherapies against a specific disease group like diarrhoea and enteric diseases has not been done earlier from this part of the state West Bengal. Thus, the present study aims to document and inventory the indigenous herbal knowledge on treatment of the diarrhoea still surviving among the rural including tribal communities in the West Bengal's lateritic belt.

Materials and methods

Study area

The field survey was conducted in different tribal pockets and adjacent forest areas of the lateritic part of West Bengal, India. This zone of West Bengal includes the west and central part of Bankura district, West Medinipur and Paschim Burdwan districts and west, south-central and northern part of Birbhum district (Goswami 1962; Chakraborty 2011). This huge zone lies between 24°50' to 22°00' North Latitude and 88°00' to 87°00' East Longitude. For data collection 34 villages spread over four districts in this region have been surveyed. The localities visited are: Ganpur, Rajnagar, Ramchandrapur, Illambazar, Kachu-

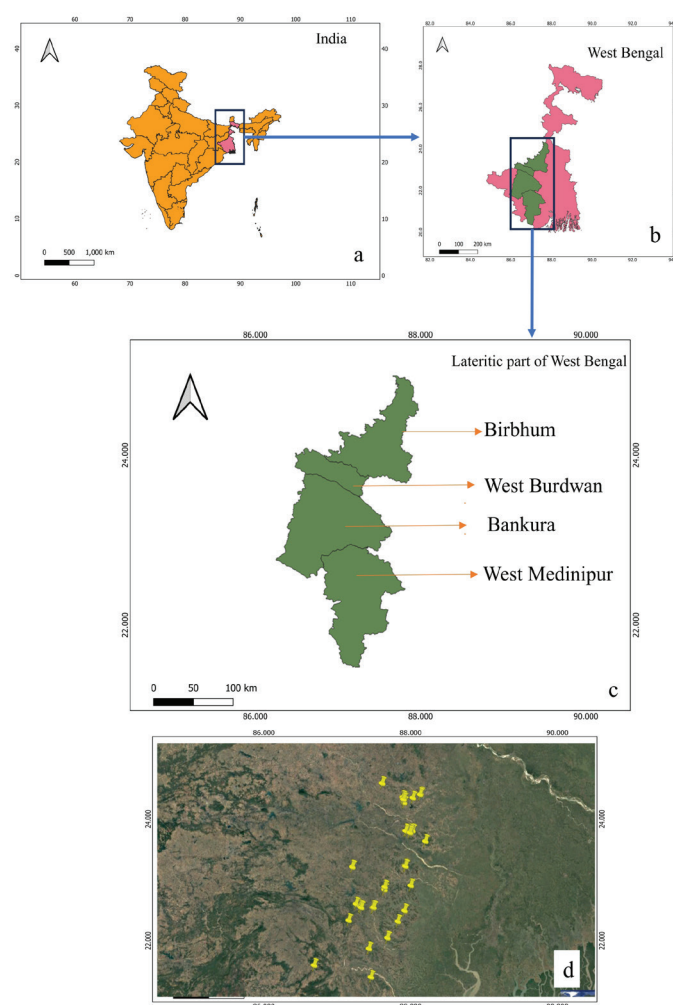


Figure 1: Map (a–d). (a) Map showing the geographical location of West Bengal in India. (b) Geographical location of Lateritic part of West Bengal. (c) The map of Lateritic part of West Bengal (d) Map depicting the various villages visited during the present study in Lateritic zone of West Bengal. (The map is created using Qgis software 3.10. and Google Earth Pro 7.3).

jore, Seorakuri, Deocha in Birbhum district (23°53′00″ to 24°04′30″ North Latitude and 87°04′30″ to 87°31′25″ East Longitude); Garjangan, Dhadika, 11-Miles, Malandighi in Paschim Burdwan (23°30′06″ to 23°56′20″ North Latitude and 87°19′00″ to 87°35′00″ East Longitude); Joypur, Beliatare, Baidkona, Nutandihi, Ranibandh, Jhilimili, Raipur, Tal-dangra, Ratanpur, Karasoli, Shahpur, Sonamukhi, Nakajhuri in Bankura district (22°50′00″ to 23°15′33″ North Latitude and 87°07′00″ to 87°25′10″ East Longitude); and Chandrabila, Garbeta, Balagarh, Manikbazar, Salboni, Godapias-al, Nayagram, Gopiballavpur, Jhargram, Jamboni in West Medinipur district (22°08′33″ to 23°36′10″ North Latitude and 86°19′11″ to 87°26′00″ East Longitude) (Figure 1).

The climate of the study area is dry and sub-humid type. The region experiences a maximum mean temperature of 38.57°C and a minimum mean temperature of 9.1°C. It has a very hot summer with dry heat and moderate winter of short duration. The average annual rainfall is 270.16 mm, primarily concentrated between June and September.

Data collection

The ethnomedicinal data were collected through regular field visits conducted between 2013 and 2017 from 34 villages across four districts (Birbhum, Paschim Burdwan, Bankura, and West Medinipur) of West Bengal, India, following standard methods (Jain 1987; Jain & Mudgal 1999). The villages were visited in all the seasons, i.e., summer, rainy, and winter seasons in order to collect the majority of plants in their blossoming state. In the present study 29 persons (26 male and 3 female) were selected as informants using the purposive sampling method (Tongco 2007) to obtain the ethnomedicinal information. Free, prior informed consent (FPIC) was obtained from each informant prior to the interview in written form. The data were gathered using semi-structured and open-ended conversations in the local Bengali language. The data regarding local names of the plants, parts used, the formulation of the crude drugs and their administration, the diseases healed, and so forth were noted.

Identification of plant species

Various Floras were consulted to establish the taxonomic identity of the plant species recorded (Varma, 1981; Sanyal, 1994, Paul *et al.*, 2015; Ranjan *et al.*, 2016). The valid names of the collected plant species were updated using the website 'Plants of the World Online' (<https://powo.sciencekew.org>). The voucher specimens were prepared from the collected plants following standard protocol (Jain & Rao, 1977). The specimens were then kept in the departmental Herbarium (VBH), Department of Botany, Visva-Bharati, Santiniketan, India for future references.

Results and Discussion

3.1 Sociodemographic profile of the informants: A total of 29 selected individuals were interviewed, and information on traditional phytotherapy was collected through multiple interviews. Detailed profiles of the informants, including their names, addresses, age, marital status, ethnicity, educational background, income sources, and sources of their traditional knowledge acquired, were meticulously documented and presented in Table 1. In terms of gender distribution, 89.65% of the informants were male (26 individuals), while only three were females (10.34%). The involvement of limited number of female informants is consistent with the previous ethnobotanical studies (Rahaman & Karmakar 2015; Subba *et al.* 2023; Singh *et al.* 2025). The majority of the informants (86.20%) belonged to the tribal community, specifically the Santal tribe, while the remaining 13.80% were in non-tribal group. Regarding educational status, 65.51% of the informants (19 individuals) were illiterate, while the remaining 34.48% (10 individuals) were literate. Among the informants, the largest portion (41.37%) fell within the age group of 51–60 yr (12 individuals), followed by 24.13% each in the age groups of 41–50 yr and 61–70 yr (7 individuals in each group). The age groups of 31–40 yr, 71–80 yr, and 81–90 yr were represented by one individual each (3.44%). Notably, no informants below the age of 40 years were found to possess knowledge of medicinal plants, highlighting a concerning gap in distribution of knowledge among the younger generations. Previous studies also reported a higher prevalence of traditional knowledge among older individuals (40+ years), with limited participation of the younger people and women (Bhattacharjee *et al.* 2024; Subba *et al.* 2024).

Transmission of knowledge and its status in the study area

The present study identified two distinct modes of knowledge transmission i.e., vertical and oblique. The vertical transmission was emerged dominant, with 79.31% of the informants (23 individuals) acquiring knowledge exclusively from their parents or grandparents. The remaining 20.68% (6 individuals) received the knowledge through oblique transmission, learning from older members of other communities, such as community heads, 'gurus', etc., irrespective of genetic or familial lineage. The knowledge transmission through vertical mode is considered vulnerable to extinction as it is restricted only in the same familial lineage. It was observed that the predominance of vertical knowledge transmission and absence of younger informants in this study raise concerns about the sustainability of this invaluable knowledge system in the studied region.

Table 1: Summary of the Sociodemographic profiles of the informants (n = 29)

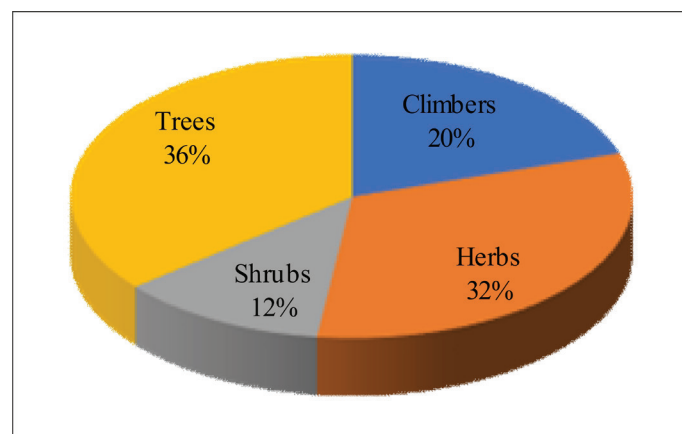
Variables	Categories	Number	Percentage (%)
Gender	Male	26	89.65
	Female	3	10.34
Age group (yr)	31-40	01	3.44
	41-50	07	24.13
	51-60	12	41.37
	61-70	07	24.13
	71-80	01	3.44
	81-90	01	3.44
Education	Illiterate	19	65.51
	Literate	10	34.48
Marital status	Married	28	96.55
	Unmarried	1	3.44

Anti-diarrhoeal ethnomedicine: Plant species reported and their families

Altogether 25 ethnomedicinal plants used to treat diarrhoea have been recorded from the study area. The recorded species belong to 15 dicotyledonous families comprising 18 genera and 21 species, 2 monocotyledonous families with 2 genera and 2 species, and 2 families from pteridophytes containing 2 genera and 2 species. Among the dicotyledonous families, Fabaceae has the highest representation with 3 species, followed by Moraceae, Anacardiaceae, and Piperaceae, each with 2 species. The remaining 11 dicot families, namely Acanthaceae, Apiaceae, Apocynaceae, Combrretaceae, Euphorbiaceae, Malvaceae, Meliaceae, Myrtaceae, Papaveraceae, Rubiaceae, and Verbenaceae, are represented by a single species each. In the monocotyledonous category, Poaceae and Zingiberaceae, each has a single species representation. Among the pteridophytes, Schizaceae and Pteridaceae contribute one species each. The dominance of anti-diarrhoeal plant species from the Fabaceae family can be attributed to their widespread distribution and abundance in the flora of this region.

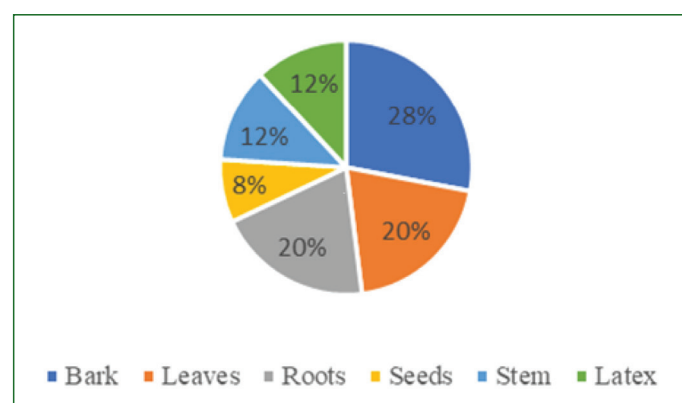
According to the habit of the plants, the reported taxa fall under four groups namely trees, shrubs, herbs, and climbers (Figure 2). Trees were the most common, with nine species making up 36% of the total documented anti-diarrhoeal plant species, followed by herbs with eight species (32%). Climbers accounted for 20% with five species, while shrubs were the least utilized group, with three plant species (12%). The high number of trees and herbs can be explained by several factors. Trees are available round the year and often accessible in rural and forest areas, making them a conve-

nient and dependable source of medicinal agents for local communities (Rahaman and Karmakar 2015). Similarly, herbs, which are the second most utilized group, offer distinct advantages. Being smaller and having a shorter height, herbs are easier to harvest than larger woody species. Their availability in different seasons in the studied region makes the herbs popular to the local communities for preparation of medicinal formulations.

**Fig. 2:** Distribution of anti-diarrhoeal plants across their habits

Plant part(s) used in crude drug preparation

Present study documented the bark as the most commonly used plant part, featuring in 28% of the ethnomedicinal preparations. Both leaves and roots were used in 20% of the medicinal recipes, while stems and latex each accounted for 12% of the formulations. Seeds were the least used, making up 8% of the medicinal preparations (Figure 3). Stem bark are more easily accessible than leaves and fruits on large trees, making it the preferred plant part for traditional medicine. Local herbalists and users ensure sustainable use of these resources by avoiding harmful methods of harvest such as ring-barking, which can severely damage the trees as phloem tissue is removed in the form of a ring from the stem circumference of trees. Instead, they employ a stripping method to collect longitudinally the small portions of bark. This careful approach helps protect the tree commu-

**Fig. 3:** Plants parts used in anti-diarrhoeal herbal preparations

nity from the life-threatening impacts of indiscriminate harvesting practices, ensuring that phytoresources are available for future generations. Local communities in the region also follow the sustainable harvesting practices collecting reasonable amounts of plant parts during collection of other plant parts such as leaves, roots, rhizomes, and seeds.

Preparation methods of the crude drugs, their administration and procurement

Of the total 25 plants involved in formulation of anti-diarrhoeal ethnomedicines, materials of 20 plants are collected by the tribal people from the wild, 2 from cultivation and 3 plant materials from commercial sources. This demonstrates the abundance of therapeutic plants in the natural habitat and also highlights the local people's reliance on wild plant sources used in preparation of remedies for healing diarrhoeal diseases.

To treat diarrhoea, a total of 17 formulations were administered. Among the recorded formulations, 9 formulations were monoherbal, and the remaining 8 formulations were polyherbal, which were prepared using more than one plant species (Table 2-3). Two plant species namely *Syzygium cumini* (bark) and *Senna alata* (root) were employed in both monoherbal and polyherbal formulations. The barks of *Butea monosperma* and *Streblus asper* are used in more than two formulations along with other herbal ingredients for treating diarrhoeal diseases in the study area. It is interesting to note that out of 17, only in one polyherbal formulation, the grain of *Piper nigrum* in 21 numbers is employed. The use of black pepper's grains in 7 or its multiple numbers is very common in ethnomedicines of many tribes such as Santhal, Munda, etc. (Pal & Jain 1998). All the therapeutic formulations were constituted by the herbalists in this area using fresh plant materials. They prefer fresh materials for preparing the remedies to ensure its maximum therapeutic potency and safety. The scientific basis of using fresh plant materials is that there is a minimum chance of loss and/or denaturation of bioactive compounds in the freshly collected plant substances and almost zero possibility of microbial load also, in comparison to previously collected dried plant ingredients. In the present study, it was noted that the oral route of remedy administration is prevalent (94.11%) and topical application is applied in case of only one monoherbal formulation from *Curcuma longa* rhizome.

New uses

One of the interesting findings of this study is that it highlights the anti-diarrhoeal uses of 6 plant species new as these have not been reported earlier in the ethnobotanical works from West Bengal and other parts of India (Kirtikar & Basu 1935; Chopra *et al.* 1956; Pal & Jain, 1998; Singh *et al.* 2003; Paria 2005; Maheshwari 2000; Bauri & Mukherjee 2013; Pradhan & Rahaman 2011; Singh and Jain 2003). Out of 25 recorded species, the six plants identified with new ethnomedicinal uses are: *Butea monosperma* (stem bark), *Jatropha curcus* (latex), *Lantana camara* (leaf juice), *Mangifera indica* (stem bark), *Senna alata* (root), and *Terminalia arjuna* (stem bark). These new findings certainly enrich the anti-diarrhoeal knowledge domain of Indian ethnopharmacopoeia.

Prospects of the anti-diarrhoeal ethnomedicine

Scientists working in the area of bioprospecting rely mainly on ethnobotanical information for discovery of natural products such as pharmaceuticals, nutraceuticals, cosmetics, and others from the bioresources. The ethno-guided lead or clue provides the highest success rate in search of prospective biomolecules than the random as well as chemo-taxonomical method employed in this field of research (Rahaman 2017). In this context, present study offers a great opportunity to the scientists to work on such ethnomedicinal clues of 17 anti-diarrhoeal remedies prepared from 25 medicinal plant species. Perusal of literature indicates that some of these 25 anti-diarrhoeal plants have been evaluated for their phytochemical attributes and anti-diarrhoeal potential. For examples, pharmacological efficacies of *Butea monosperma*, *Senna alata* (= *Cassia alata*) and *Grona triflora* (= *Desmodium triflorum*) in healing the diarrhoea as well as amoebic dysentery have been established through a number of scientific studies (Gunakkunru *et al.* 2005; Espinosa *et al.* 2020; Oguwike *et al.* 2023). Besides, out of 25 species four plants namely, *Saccharum officinarum*, *Diplocyclos palmatus*, *Lygodium flexuosum*, and *Adiantum lunulatum* were found unexplored for their anti-diarrhoeal activities. Despite their traditional medicinal significance, no substantial research has been conducted to evaluate their potential in treating diarrhoea. Thus, present investigation highlights exciting avenues for scientific exploration toward the development of novel anti-diarrhoeal agents.

Table 2: List of anti-diarrhoeal plants used for preparing the monoherbal formulations (n=09)

S. No.	Scientific name and Family	Local name	Part(s) used	Method of preparation and dose regime	Mode of administration
1.	<i>Calotropis gigantea</i> (L.) W.T. Aiton (Apocynaceae)	Ahauna	Latex	Half a teaspoon of the plant's latex is mixed with 1–2 g of sugar and taken orally twice a day for 2–3 days.	Oral

S. No.	Scientific name and Family	Local name	Part(s) used	Method of preparation and dose regime	Mode of administration
2.	<i>Centella asiatica</i> (L.) Urb. (Apiaceae)	Thalkuri	Leaf	3-4 leaves are chewed once daily on an empty stomach for five days	Oral
3.	<i>Curcuma longa</i> L. (Zingiberaceae)	Sasang	Rhizome	About 2 cm of rhizome is tightly bound to the body for seven days to treat diarrhoea in children.	Topical
4.	<i>Ficus benghalensis</i> L. (Moraceae)	Bari-daru	Aerial root	Small pieces of young aerial roots are ground into a paste (up to 25 g) and mixed with 50 g of sugar (1:2) to prepare tablets. Two tablets are taken twice daily after a meal for seven days.	Oral
5.	<i>Jatropha curcas</i> L. (Euphorbiaceae)	Birjara, Bagrendi	Latex	The latex of <i>J. curcas</i> is mixed with sugar in a 1:3 ratio and administered orally on an empty stomach twice a day for 3–4 days.	Oral
6.	<i>Lantana camara</i> L. (Verbenaceae)	Puhes, Saibanilata	Leaf	10- 15 leaves are ground into a paste and made into 3–5 tablets. One tablet is administered orally twice a day for four days.	Oral
7.	<i>Piper longum</i> L. (Piperaceae)	Rali	Bark and leaf	The bark and leaves are ground into a paste, then filtered. Half a cup of the juice is administered orally once a day for 2–3 days.	Oral
8.	<i>Senna alata</i> (L.) Roxb. (= <i>Cassia alata</i> L.) (Fabaceae)	Dadmardan	Root	The roots are ground into a paste, then the paste is filtered, and one teaspoonful of the juice is administered orally twice a day for 3–4 days.	Oral
9.	<i>Syzygium cumini</i> (L.) Skeels (Myrtaceae)	Jamon	Bark	Half cup of bark paste of the plant mixed with few drops of lime [Ca(OH) ₂] water and administered orally twice a day for 2-3 days.	Oral

Table 3: List of anti-diarrhoeal medicinal plants used for preparing the polyherbal formulations (n=08)

S. No.	Scientific name and family	Local Name	Part(s) used	Mode of preparation of crude drug and dose regime	Method of administration
1.	<i>Adiantum lunulatum</i> Burm.f. (Pteridaceae)	Kalijhant	Rhizome	Half a cup of root paste from <i>A. lunulatum</i> , <i>A. paniculata</i> , <i>L. flexuosum</i> , and <i>P. foetida</i> (in 1:1:1:1 ratio) is administered orally twice a day for 3–4 days.	Oral
	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees (Acanthaceae)	Bhui-nimb	Root		
	<i>Lygodium flexuosum</i> (L.) Sw. (Lygodiaceae)	Durga-jhasi, Sibkashi	Root		
	<i>Paederia foetida</i> L. (Rubiaceae)	Ganddhat	Root		
2.	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	Bokom dare, Nim-daru	Bark	The bark of <i>A. indica</i> , <i>T. arjuna</i> , <i>M. indica</i> , and <i>S. cumini</i> (in equal proportions, 1:1:1:1) is ground into a paste and mixed with a few drops of lime water [Ca (OH) ₂]. This mixture is then administered orally once daily for three days.	Oral
	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn. (Combretaceae)	Kanha	Bark		
	<i>Mangifera indica</i> L. (Anacardiaceae)	Aam	Bark		
	<i>Syzygium cumini</i> (L.) Skeels (Myrtaceae)	Jamon	Bark		

S. No.	Scientific name and family	Local Name	Part(s) used	Mode of preparation of crude drug and dose regime	Method of administration
3.	<i>Butea monosperma</i> (Lam.) Kuntze (Fabaceae)	Palas-baha	Bark	The barks of <i>B. monosperma</i> and <i>S. asper</i> are taken in equal proportions (1:1), ground into a paste, and filtered. One teaspoonful of the juice is administered orally in the morning for 3–4 days.	Oral
	<i>Streblus asper</i> Lour. (Moraceae)	Sahra, Ote-chum	Bark		
4.	<i>Grona triflora</i> (L.) H. Ohashi & K. Ohashi [= <i>Desmodium triflorum</i> (L.) DC.] (Fabaceae)	Sadan-kchur, Herem-ara	Whole plant	The whole plant of <i>G. triflora</i> and the barks of <i>S. asper</i> and <i>B. monosperma</i> are taken in equal proportions (1:1:1), ground into a paste, and filtered. One teaspoonful of the juice is administered orally in the morning for 3–4 days.	Oral
	<i>Butea monosperma</i> (Lam.) Kuntze (Fabaceae)	Palas-baha	Bark		
	<i>Streblus asper</i> Lour. (Moraceae)	Sahra, Ote-chum	Bark		
5.	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey (Cucurbitaceae)	Mala-dare	Root	About 2–3 cm of the root of <i>D. palmatus</i> and <i>S. alata</i> (1:1) is chewed once a day for 3–4 days.	Oral
	<i>Senna alata</i> (L.) Roxb. (Fabaceae)	Dadmardan	Root		
6.	<i>Lannea coromandelica</i> (Houtt.) Merr. (Anacardiaceae)	Doka-dare, Jibal-daru	Bark	The barks of <i>S. asper</i> and <i>L. coromandelica</i> (1:1) are ground into a paste and then filtered. Half a cup of the juice is administered twice a day for 4–5 days after a meal.	Oral
	<i>Streblus asper</i> Lour. (Moraceae)	Sahra, Ote-chum	Bark		
7.	<i>Piper nigrum</i> L. (Piperaceae)	Golmorich	Fruit	Around 21 fruits of <i>P. nigrum</i> of along with 2–3 cm of stem from <i>S. rhombifolia</i> are ground into a paste and administered orally once a day on an empty stomach for 3 days.	Oral
	<i>Sida rhombifolia</i> L. (Malvaceae)	Super-godha	Stem		
8.	<i>Papaver somniferum</i> L. (Papaveraceae)	Pustu	Seed	About 10 g of opium seeds are ground into a paste and mixed with half a cup of sugarcane stem juice. The mixture is administered orally once a day for 4–5 days.	Oral
	<i>Saccharum officinarum</i> L. (Poaceae)	Akh	Stem		

Conclusion

The current study underscores the significance of the lateritic part of West Bengal as a rich repository of traditional ethnomedicinal knowledge on diarrheal disease management. The documentation of 25 potential ethnomedicinal plants used to cure diarrhoea highlights the extensive knowledge base of the tribal and rural communities in this region. The prevalence of diarrhoea in this area and the reliance on 17

ethnomedicinal formulations for its treatment emphasize the importance of preserving this traditional knowledge heritage through the present documentation. By documenting 25 plant species, the present study contributes significantly to the existing databank of 419 anti-diarrhoeal plants estimated through perusal of relevant literature on medicinal plants of India, and enriches the national as well as state level inventory on traditional herbal knowledge.

The present research work also provides an immense opportunity to the scientists to validate the rationale of anti-diarrhoeal claims associated with the documented 25 medicinal plant species and to develop more effective drugs for treatment of diarrhoea.

Furthermore, it is evident from the present study that the tradition of folk herbal practices in the study zone is facing the threat of cultural erosion. To address this challenge, a multidisciplinary effort is necessary to conserve the traditional herbal practices and its related plant resources, and the cultural heritage of the local communities.

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Conflicts of Interest

The authors declare no conflict of interest.

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Ethnomedicine for bone-fractures used by the tribes of Adilabad district, Andhra Pradesh

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Abstract

The paper deals with 20 species of plants covering 15 families used by the tribes of Adilabad district for curing bone fractures. Fabaceae is the dominant family with four species followed by others. Shrubs and trees are dominant with seven species each. Six practices were found to be new.

Key words: Bone fractures, Adilabad district, Andhra Pradesh, Pharmacognosy, Pharmacology

Introduction

From time immemorial, man has been interested in trying to control diseases. The history of medicine thus contributes review of the evolution of man and human knowledge during the 20th century and made medicine more complex. Adilabad district is situated between 77° 47' and 80° 0' of the eastern longitudes and 18° 40' and 19° 56' of the northern latitudes. It is bounded on North by Yeotmal and Chanda districts of Maharashtra, on the East by Chanda district, on the South by Karimnagar and Nizamabad districts and on the West by Nanded district of Maharashtra state. It ranks second among all the districts in the state in forest area occupying about 44.5 per cent (7218.86 Sq km). The total tribal population of the district is 495,794 (18.08%) (2011 census) and the main tribes are Gonds, Kolams, Koyas, Lambadas, Mannes, Naikpods, Pradhans, Thoties and Yerukalas. Though, there are publications on antidotes, antipyretic, asthma, cold and cough, diarrhea and dysentery, earache, headache, ichthyotoxic plants, jaundice, leucorrhea, rheumatoid arthritis, sexually transmitted diseases, tooth ailments, and women problems (Ravishankar & Henry 1992; Imam *et al.* 1997; Swamy & Reddi 2010, 2011, 2014, 2016a,b,c; 2017a,b,c; 2018a,b; 2019, 2020, 2021), exclusive studies on bone fractures on the tribes of Adilabad district were not observed so far, which have been covered in the present study.

Materials and Methods

Extensive ethnobotanical explorations were conducted in 42 tribal pockets with good forest cover in Adilabad district during 2006-2009. Knowledgeable informants including the *vaidyas* and elderly persons (42) of the tribal communities were interviewed and obtained information on the plants and their parts used for healing bone fractures. The data were verified in different villages among the interviewers showing the same plant sample and even with same informants on different occasions. The knowledgeable informants were taken to the field and along with the collection of plants for verifying the voucher specimens, the uses of those plants as given by them were recorded in the field itself. The voucher specimens were deposited in the Herbarium of the Department of Botany (AUV), Andhra University, Visakhapatnam.

Enumeration

The plants are enumerated and arranged in an alphabetical order with botanical name followed by family, vernacular name, locality, collector's name, voucher number, tribal informant, part(s) used, method, mode and duration of treatment. Plants and practices marked with an asterisk (*) are considered to be new or less known.



Alternanthera sessilis (L.) DC. (Amaranthaceae)
‘Ponnaganti kooru’, Mamad, NSS 7780, Gonds
Whole plant paste mixed with egg albumen is plastered till cure.

Cascabela thevetia (L.) Lippold (Apocynaceae) ‘Pachcha ganneru’, Tadolpet, NSS 7630, Kolams
Leaves are ground and the paste is plastered on the broken region till cure.

Cochlospermum religiosum (L.) Alston (Cochlospermaceae) ‘Konda gogu’, Itikayal, NSS 7974, Pradhans
Stem bark paste mixed with egg albumen is plastered till cure.

Dichrostachys cinerea (L.) Wight & Arn. (Fabaceae)
‘Veluturu chettu’, Perapalli, NSS 7366, Koyas
Roots are ground with *Piper nigrum* seeds and the paste is given orally in two spoonful twice a day, and also paste mixed with goat’s milk is plastered over the fractured area till cure.

Dodonaea viscosa Jacq. (Sapindaceae) ‘Puli–vaieu’, Kadem, NSS 7874, Naikpads
Leaf paste mixed with turmeric is plastered over the broken parts.

Euphorbia tirucalli L. (Euphorbiaceae) ‘Manchi jamudu’, Kundaram, NSS 7542, Thoties
*Stem juice is taken in two spoonful with ½ glass of goat’s milk twice a day for 30-45 days and also the paste is plastered around broken parts till cure.

Orthosiphon rubicundus (D. Don) Benth. (Lamiaceae)
‘Nela tappidi’, Enchapalli, NSS 7470, Mannes
*Whole Plant paste mixed with egg albumen is plastered on broken parts for two months or till cure.

Oxalis corniculata L. (Oxalidaceae) ‘Nela chinta’, Neelwai, NSS 7680, Lambadas
Whole plant paste mixed with egg albumen is plastered on broken parts till cure.

Pergularia daemia (Forssk.) Chiov. (Apocynaceae)
‘Dustapa teega’, Bejjur, NSS 7846, Yerukalas
Leaves are ground with leaves of *Plumbago zeylanica* and the paste is plastered on the broken areas till cure.

Phyllanthus emblica L. (Euphorbiaceae) ‘Pedda usiri’, Bheemini, NSS 8426, Mannes
*Stem galls are ground with leaves of *Vanda tessellata* and the paste is plastered over the broken parts till cure.

Polyalthia cerasoides (Roxb.) Chaowasku (Annonaceae)
‘Chilaka dudi’, Tiryani, NSS 8434, Koyas
*Stem bark ground with goat’s milk is plastered on broken parts.

Schleichera oleosa (Lour.) Oken (Sapindaceae) ‘Pusku chettu’, Rebenna, NSS 8478, Naikpods
Stem bark paste mixed with egg albumen is plastered on broken parts till cure.

Senegalia intsia (L.) Maslin, Seigler & Ebinger (Fabaceae)
‘Korinda’, Karjelly, NSS 8060, Kolams
Root bark paste mixed with egg albumen is plastered for 2-3 months or till cure.

Senna auriculata (L.) Roxb. (Fabaceae) ‘Tangedu’, Tiryani, NSS 7214, Pradhans
Leaf paste with egg albumen is plastered over the broken parts till cure.

Senna siamea (Lam.) H.S. Irwin & Barneby (Fabaceae)
‘Nela tangedu’, Kawal, NSS 7374, Lambadas
*Leaf paste is plastered over the broken parts.

Sida acuta Burm. f. (Malvaceae) ‘Parasu kampa’, Lohesra, NSS 7014, Koyas
Leaf paste mixed with egg albumen is plastered on broken parts till cure.

Solanum virginianum L. (Solanaceae) ‘Mulla vankaya’, Kubeer, NSS 8458, Mannes
*Whole plant ground with sesame oil is plastered on broken parts.

Stephanotis volubilis (L.f.) S.Reuss, Liede & Meve (Apocynaceae)
‘Doodi pala’, Mamda, NSS 8532, Pradhans
Stem bark paste ground with those of *Ficus benghalensis* and *Soymida febrifuga* is plastered on broken parts till cure.

Terminalia arjuna (Roxb. ex DC.) Wight & Arn. (Combretaceae) ‘Arjuna chekka’, Tanur, NSS 7058, Yerukalas
Stem bark extract is administered in two spoonful with ½ glass of milk once at night for 30-45 days and the bark paste is plastered on broken parts till cure.

Ziziphus oenoplia (L.) Mill. (Rhamnaceae) ‘Pariki’, Kerameri, NSS 8304, Lambadas
Leaf paste mixed with gum of *Sterculia urens* is plastered over the broken parts till cure, and also this decoction with leaf

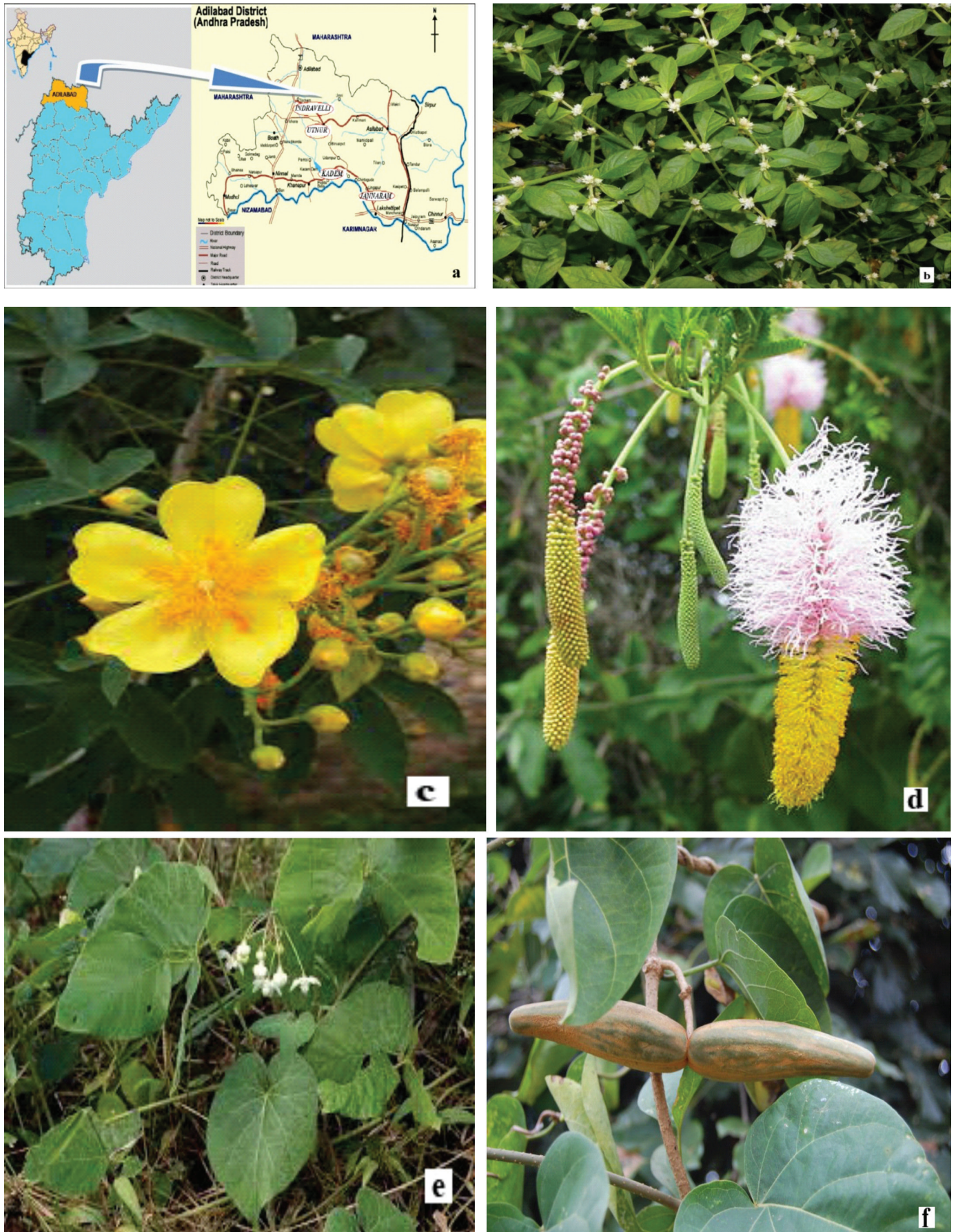


Plate 1: a. Map of study area; b. *Alternanthera sessilis* (L.) R. Br. ex DC.; c. *Cochlospermum religiosum* (L.) Alston; d. *Dichrostachys cinerea* (L.) Wight & Arn.; e. *Pergularia daemia* (Forssk.) Chiov.; f. *Wattakaka volubilis* (L.f.) Stapf

decoction of *Acacia chundra* is given orally in two spoonful twice a day for three weeks.

Results and Discussion

The paper deals with 20 species of plants covering 19 genera and 13 families used by the tribes of Adilabad district for healing bone fractures. Among these Fabaceae is the dominant family with four species followed by Apocynaceae (three spp.), Sapindaceae, Euphorbiaceae (two spp. each) and others with one species each. Habit-wise analysis showed the dominance of shrubs and trees with seven

species each followed by herbs (five spp.) and one climber. Morphological analysis showed the maximum utilization of leaf in seven practices followed by stem bark (five), whole plant (four), stem (two), root and root bark (one each). They are administered mostly in the form of paste mixed with egg albumen and plastered on the broken parts along with either sesame oil, milk, goat milk, or turmeric. Six practices were found to be new or less known (Jain 1991; Kirtikar & Basu 2003; Jain & Jain 2016). Plants used for similar purpose by the tribals in different parts of India are also presented in Table 1.

Table 1: Plants used for similar purpose in different parts of India

S. No.	Plant species	Tribes/Area/Region/Country	Reference(s)
1.	<i>Senna auriculata</i>	Rural folk, Yanadi and Nakkala tribes of Chittoor district, Andhra Pradesh Irular tribe of Coimbatore district, Tamil Nadu	Reddy <i>et al.</i> (1989) Umapriya <i>et al.</i> (2011)
2.	<i>Sida acuta</i>	Katkari, Kokana, Mahadeo koli, Thakar, Warli tribes of Western Maharashtra	Upadhye <i>et al.</i> (1994)
3.	<i>Dodonaea viscosa</i>	Halakki, Lambani, Kadukuruba, Pindari, Korcha tribes of North-eastern Karnataka People of Gulbarga district, Karnataka Solan district, Himachal Pradesh	Seetharam <i>et al.</i> (1999) Ghatapanadi <i>et al.</i> (2011) Sharma <i>et al.</i> (2020)
4.	<i>Stephanotis volubilis</i>	Warli, Konkana, Dhodia, Dubala, Katkari, Naika, Koli tribes of Dadra and Nagar Haveli	Sharma & Singh (2001)
5.	<i>Terminalia arjuna</i>	Kondadora, Kotia, Valmiki, Bhagat, Samantha, Konda kummari, Gadaba and Poranji porja tribes of Paderu Forest Division of Visakhapatnam district, Andhra Pradesh Bodo tribe of Kamrup district, Assam Folklore of Amravati district, Maharashtra Tribals of Maharashtra and Gujarat Chakma tribe of Namdapha National Park, Arunachal Pradesh Folklore of Guntur district, Andhra Pradesh Bhil, Pardhi, Laman, Vadar, Kaikadi, Pardhan, Andh, Vaidu tribes of Aurangabad district, Maharashtra Singpho, Tangsa, Lisu, Tutsa, Chakma tribes of Changlang district, Arunachal Pradesh Gond, Bhunjia, Binjihal, Sabar tribes of Naupada district, Odisha	Rao <i>et al.</i> (2001) Gogoi & Borthakur (2001) Bhogaonkar & Ahmad (2007) Parabia & Pathak (2008) Sarmah <i>et al.</i> (2008) Babu & Ammani (2010) Mali & Bhadane (2011) Sarmah <i>et al.</i> (2011) Kandi <i>et al.</i> (2012)
6.	<i>Alternanthera sessilis</i> , <i>Cochlospermum religiosum</i> , <i>Dichrostachys cinerea</i> , <i>Dodonaea viscosa</i> , <i>Senegalia intsia</i> , <i>Oxalis corniculata</i> , <i>Senna auriculata</i> , <i>Sida acuta</i> , <i>Ziziphus oenoplia</i>	Healers of Eastern Ghats, Andhra Pradesh	Suneetha <i>et al.</i> (2011)
7.	<i>Cascabela thevetia</i> , <i>Senegalia intsia</i> , <i>Senna auriculata</i>	Khond, Porja, Gadaba and Savara primitive tribal groups of North-coastal Andhra Pradesh	Rao <i>et al.</i> (2013)

S. No.	Plant species	Tribes/Area/Region/Country	Reference(s)
8.	<i>Schleichera oleosa</i>	Kondh, Gond, Saura, Mirdha, Munda, Kharia, Kora, Kolha tribes of Boudh district of Odisha	Sahu <i>et al.</i> (2013)
9.	<i>Pergularia daemia</i>	Chenchu and Sugali tribes of Nallamalais, Andhra Pradesh	Saheb (2014)
10.	<i>Cochlospermum religiosum</i>	People of Madhya Pradesh	Jadhav (2017)
11.	<i>Alternanthera sessilis</i>	People in Shivalik Range of Panchkula, Haryana	Balakrishna <i>et al.</i> (2018)
12.	<i>Cochlospermum religiosum</i> , <i>Terminalia arjuna</i>	People of Madhya Pradesh	Jadhav (2020)

The present study yielded interesting data and provide scope for further studies to understand the scientific basis of the uses of crude drugs. The plants included in the present study needs to be scrutinized pharmacognostically as well as pharmacologically. The phytochemical analysis may also be undertaken for the scientific validation of the folklore claims. Besides, these plants can be added to the list of herbal drugs.

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Wild edibles in cultural landscape of Maharashtra: ‘Waghati’ (*Capparis zeylanica* L.) and ‘Jivati’ (*Telosma pallida* (Roxb.) Craib)

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Abstract

Maharashtra's cultural and ecological heritage is deeply connected with wild edible plants. ‘Waghati’ (*Capparis zeylanica* L.) and ‘Jivati’ (*Telosma pallida* (Roxb.) Craib) hold a unique place in local traditions, festivals and medicinal practices; especially of Vidarbha and Marathwada region. ‘Waghati’ is linked with the Ashadhi Ekadashi fasting and Rishi Panchami rituals. Medicinally it is valued for its anti-diabetic, anti-inflammatory and antimicrobial properties. Similarly, ‘Jivati’, central to Jivati Puja during the Shravan month, offers vital medicinal benefits, including immuno-modulatory and anti-inflammatory effects. Both plants address seasonal health issues, such as respiratory and digestive disorders common during the monsoon season.

However, these species are under threat due to habitat destruction and the erosion of traditional knowledge and beliefs. Present study incorporates ethnobotanical and market survey along with literature review to assess the cultural and medicinal importance of ‘Waghati’ and ‘Jivati’. To ensure their conservation, the study advocates for sustainable cultivation of these plants. Planting ‘Waghati’ along field boundaries and promoting the cultivation of ‘Jivati’ can support both conservation and local economy. Strengthening conservation efforts and reviving knowledge based traditional practices are essential for safeguarding the future of these plants.

Key words: *Capparis zeylanica*, *Telosma pallida*, Wild edible plants, Cultural landscape, Conservation

Introduction

India has a profound history of integrating nature into its spiritual, cultural and medicinal traditions. Wild edible plants have long been revered for their therapeutic properties and their role in religious and culinary practices. Many of these plants are mentioned in ancient Ayurvedic texts such as Charaka Samhita and Sushruta Samhita, which highlight their significance in promoting health and longevity (Dash & Sharma 2014). The traditional use of wild edibles ensures the continuity of indigenous knowledge while supporting biodiversity conservation. Their presence in folk traditions and oral histories further emphasizes their importance in sustaining local ecosystems and communities (Gadgil & Var-tak 1996).

Many wild edibles are used as Naivedyam in religious festivals in Maharashtra. *Commelina benghalensis* L. is used on

one of the Saturday of Shrawan (Datar & Upadhye 2016). Kshirsagar and Bhogaonkar (2025) reported *Chlorophytum tuberosum* (Roxb.) Baker, *Colocasia esculenta* L., *Dioscorea bulbifera* L., *Dioscorea alata* L., *Ledebouria revoluta* (L.f.) and *Oryza rufipogon* Griff. being used in different festivals in Thane district.

‘Waghati’ (*Capparis zeylanica* L.) fruit is used in many parts of India such as Madhya Pradesh, Maharashtra and Andhra Pradesh (Datar & Upadhye 2016; eFlora of India 2023; Useful Tropical Plants Database 2023). ‘Jivati’ (*Telosma pallida* (Roxb.) Craib) flowers are used in Maharashtra as well as Gujarat (Kanakhara *et al.* 2016; Kanakhara *et al.* 2018). Jivati Pooja is performed in all parts of Maharashtra but Naivedyam of Jivati flower is offered only in Vidarbha and Marathwada region. Despite their cultural and medicinal significance, these species are under threat due to habitat



destruction, urbanization and declining traditional knowledge. It has been observed that over the years population of *Capparis zeylanica* L. (Waghathi) and *Telosma pallida* (Roxb.) Craib (Jivati) is decreasing. This has resulted in their low availability and increased market price. The conservation of these plants is imperative for maintaining Maharashtra's biodiversity and preserving its cultural heritage. Present attempt aims to document the religious and cultural importance, nutritional significance and medicinal properties of 'Waghathi' and 'Jivati' while proposing conservation strategies for their sustainable utilization.

Methodology

The study is based on ethnobotanical cultural study, market surveys and review of literature. Material was collected from field, herbarium specimens prepared, numbered and deposited in Department of Botany, Smt Radhabai Sarda College Anjangaon Surji, Dist. Amravati (Maharashtra).

Results and Discussion

'Waghathi' (*Capparis zeylanica* L.; Family - Capparaceae) Specimen no. MJD105

Sanskrit Names: 'Ahimsara', 'Govindi' / 'Govind Phal' and 'Vyaghrnakhi'

Morphology

Perennial, climbing, thorny shrub. Leaves smooth, simple, opposite, oblong-ovate, 5 - 12 cm long and 2 - 7 cm wide, margin entire. Flowers axillary, solitary, fragrant, petals long, white, the lower pair spreading, the upper approximate and with pink spot at the base. Fruits spherical, green, turning yellow on maturity, about 1.5 - 2 cm in diameter.

Fruiting- June to August.

Plant thrives in dry, rocky environment, often found on hill-sides, in forests and along fences.

The fruit is used to make vegetable. In Maharashtra, there is still a tradition of breaking the fast on the day after Ashadhi Ekadashi by consuming the vegetable of 'Waghathi' fruits. This practice is especially prevalent in Vidarbha and Marathwada region. In western Maharashtra devotees of Lord Vitthal also eat this vegetable to break the fast of Ashadhi Ekadashi.

Rishi Panchami is a festival worshipping Sapt Rishi of Puranas. On this day, vegetable of 'Waghathi' is offered as a part of Naivedyam.

Recipe

The outer skin of fruit (epicarp) is hard; removed before making vegetable.

Recipe-1

Oil is heated in a cooking pan and cumin seeds, mustard seeds and asafoetida are added. As the seeds crackle, pieces of green chili, red chili powder, turmeric powder and salt added. Then, the cut vegetable is mixed with this seasoning and the pan is covered. Some water may be added as needed and the vegetable is allowed to cook.

Recipe-2

Oil is heated in a cooking pan. Cumin seeds and mustard seeds are added, followed by a paste of garlic, finely cut onion and grated coconut or groundnut powder and is shallow-fried. Then red chilli powder, turmeric and salt are added to this fried paste. The cut vegetable is mixed in and allowed to cook. Water can be added as needed to make curry.

Recipe-3

Soaked *Cicer arietinum* (chana dal) mixed with cut vegetable is cooked as per recipe number one.

Nutraceutical value

Nutrition Per 100g fruit

Protein: 1.6 g, Carbohydrates: 10.8 g, Fibers: 3.5 g, Vitamin C: 40.0 mg, Calcium: 40.0 mg, Iron: 2.5 mg, Magnesium: 35.0 mg (Sharma *et al.* 2013).

Bioactive Compounds

'Waghathi' contains saponins, glycosides, flavonoids, and alkaloids, which contribute to its medicinal properties (Gayathri & Krishnaraju 2015).

Market value and availability

Upon conducting market survey, it was observed that the availability of this plant is very limited and hence it is quite expensive. Additionally, the fruit of 'Waghathi' is also sold in the market as a wild vegetable. Due to its medicinal and nutritional properties, as well as its limited availability, it commands a higher market price. Generally, the cost of this fruit ranges from 150 to 300 Rs. per kg in Vidarbha region. On the day after Ashadhi Ekadashi, in some regions, a single fruit is sold for Rs. 5-15/-. (Fig. 1)



Fig. 1: 'Waghati' (*Capparis zeylanica* L.) fruits for selling in market by the locals

Medicinal Uses

In ethnomedicine, the plant is used for treatment of blisters, cholera, colic, hemiplegia, neuralgia, pneumonia, rheumatism, and ulcers. Root bark is used for treating boils, cholera, as an anthelmintic and for swellings of testicles. Root is applied on snake bite. Leaves are applied for boils, piles and swellings (Jain 1991).

Use of this plant is found in the Sushruta Samhita and Ayurveda. Its roots, leaves, and especially fruits are used for treatment of various diseases (Warrier 1994; Kirtikar & Basu 1935).

The roots of 'Waghati' possess the ability to reduce Pitta and Vata. According to Ayurveda, roots are used to improve digestion, lower blood pressure and treat diabetes. Decoction made from its roots helps in detoxifying the body (Gupta & Shukla 2014).

Decoction of roots and leaves is used to treat constipation and digestive disorders. Root bark is used as a stomachic, anticholera, diuretic and febrifuge. The leaves have significant medicinal properties. They are effectively used to treat cough, diarrhoea and phlegm related disorders. Juice of leaves mixed with black pepper powder is used to treat diarrhoea. Additionally, they are also used to reduce inflammation and swellings in the body (Kumar *et al.* 2015).

Leaves are used to treat cough and cold (Mishra, 2006). Leaves are applied as a poultice for piles, swellings and boils (Khare 2007). Waghati bark and leaves have been used to treat wounds and skin infections due to their antimicrobial properties (Lather *et al.* 2011; Sharma *et al.* 2013).

Fruits of 'Waghati' possess Pitta-balancing, Vata-reducing and anti-diabetic properties. They help in regulating blood

sugar levels and are also known to stimulate appetite. Consumption of these fruits enhances immunity and aids digestion (Sharma *et al.* 2013). Many of the medicinal uses are experimentally proved in scientific investigations.

Methanolic extract of the plant exhibited significant antipyretic activity in yeast-induced fever models in rats (Padhan *et al.*, 2010). Methanolic extract of the root demonstrated both central and peripheral analgesic effects in experimental models using rats and mice (Upaganlawar *et al.* 2008). Methanolic extract of the root was tested on rats for wound healing properties. Its 2% concentration showed better healing compared to providone-iodine ointment (Das *et al.* 2011). Ethanolic root extract has hepatoprotective potential (Hota *et al.* 2022). Leaves exhibited potent immunostimulant activity through serological and haematological tests (Ghule *et al.* 2006). Leaf extracts showed significant anti-ulcer activity, with 88.5% inhibition in HCl-ethanol induced ulcers and 83.78% inhibition in indomethacin induced ulcers (Sini *et al.* 2011). Leaf extracts displayed strong antioxidant potential by scavenging DPPH, superoxide and hydroxyl radicals, comparable to ascorbic acid (Kumar *et al.* 2019). Breast cancer stands second to all cancers for a cause of death as per Globocan, 2018; in India, 14 % deaths were found to be associated with breast cancer. Ethanolic leaf extract showed 66.68% cell growth inhibition against MCF-7 human breast cancer cells (Warake *et al.* 2021).

Methanolic extract of fruits showed 81.82 % enhanced circulating insulin level than the diabetes controlled rat (Balekari & Veeresham 2015). The fruit is used traditionally to regulate blood sugar levels and manage diabetes (Patil *et al.* 2017).

Need of conservation and cultivation

The 'Waghati' plant has high market demand and the price of its fruits has also increased. This plant is both medicinal

and nutritious, making its conservation essential. The cultivation is easier since seedlings can be easily grown from seeds. Bringing this medicinally and traditionally important plant under cultivation is beneficial both from conservation and economic point of view. Since this medicinal plant belongs to the shrub-vine category, farmers can grow it along the fences of their fields, where it can act as protective bio-fencing because of the presence of claw-like spines. This will ensure its conservation, while also gaining financial benefits from it.

'Jivati' (*Telosma pallida* (Roxb.) Craib; Family- Apocynaceae)
Specimen no. MJD106

The Sanskrit name 'Jivati'—meaning 'Life-giving' signifies its association with reproduction, longevity and health.

It is also known as 'Jhutel' in Maharashtra and 'Radarudi' and 'Vacchanti' in Gujarat. In Hindi, it is known as 'Surkilla'.

Morphology

Perennial, twining undershrub. Leaves simple, opposite, ovate to oblong, 6 - 12 cm long and 4 - 8 cm wide. Flowers fragrant, pale yellow, often arranged in clusters, tubular, 5-lobed; corona staminal. Fruit a follicle; seeds small, numerous.

Flowering: July to September.

It is found in tropical and subtropical forests, grasslands and near agricultural areas. Not of common occurrence; especially found in Vidarbha and Marathwada regions of Maharashtra. It is used both in culinary practices and as a medicinal plant.

The flower is traditionally used to make vegetable. 'Jivati' is deeply embedded in the cultural and religious practices of Maharashtra. It is an essential part of the 'Jivati Pooja'

done in Shravan month on Friday. The vegetable is offered as a part of 'Naivedyam'. 'Jivati' is Goddess of fertility, often shown surrounded by small children. She is also supposed to protect the children from evil spirits. 'Jivati' is worshiped on 5th day of child's birth. After 'Jivati pooja', image of 'Jivati' embossed on round golden piece is tied around the neck of the child. This is to protect the child from all evils and for long life. This is kept till child becomes three years old as medically up to three years age, children are more susceptible to infectious diseases.

Recipe

Oil is heated in a cooking pan and cumin seeds are added. As the seeds crackle, pieces of green chilli, red chilli powder, turmeric powder, crushed onion pieces, fenugreek seeds and salt added. Then, flowers of *T. pallida* are mixed with this seasoning, and the pan is covered and the vegetable is allowed to cook (Fig. 3).

Nutraceutical value

Nutrition per 100g Fresh Weight

Protein: 0.88 g, Carbohydrate: 1.58g, Fat: 0.48g, Crude Fibre: 0.93g, Vitamin C: 1.566mg, β -Carotene: 172.5 μ g, Calcium: 148 mg, Phosphorus: 11 mg, Iron: 11 mg, Sodium: 340 mg, Potassium: 81 mg (Rajgure 2017).

Bioactive Compounds

'Jivati' contains glycosides, flavonoids, alkaloids, steroids, which contribute to its medicinal properties (Umaretiya *et al.* 2021).

Market Value and availability

It was observed that the availability of this plant is very limited. If the cultivation of this medicinal plant is encouraged, its availability will increase, providing significant benefits and support to farmers. Additionally, it will enable the general



Fig. 2: 'Jivati' (*Telosma pallida* (Roxb.) Craib) flowers for selling in the market

public to access this nutritious and health promoting wild vegetable more easily. Generally, the cost of these flowers ranges from 150 to 200 Rs. per kilogram in Vidarbha and Marathwada region. (Fig. 2)

Medicinal Uses

In ethnomedicine, the plant is traditionally used to treat various ailments such as respiratory issues, digestive disorders and inflammatory conditions. It is also used to treat various ailments such as whooping cough, cold and asthma (Patil & Pawar 2018). The plant's medicinal properties have made it an essential part of traditional healing practices. Roots are utilized for treating stomach-related ailments, fever and joint pain (Bhatt *et al.* 2016). The leaves are applied externally to wounds, boils and swellings, while the flowers are known for their use in managing menstrual disorders and skin diseases (Kanakhara *et al.* 2016). The fruit is consumed as a vegetable and is believed to enhance vitality and stamina in traditional medicine (Umaretiya *et al.* 2021).

In Ayurveda, this plant is recognized for its Kapha and Vata pacifying properties. The roots are used for enhancing digestion, detoxifying the body and improving liver function. The plant is also known for its blood-purifying properties and is used in treating chronic skin conditions. It helps to regulate blood sugar levels and improve insulin sensitivity (Khare 1984; Umaretiya *et al.* 2021).

The plant is used for treating whooping cough and asthma through decoctions made from leaves and twigs (Panda & Satapathy 2006). Decoction of roots is beneficial for expelling intestinal worms and treating digestive disorders (Kanakhara *et al.* 2016). Leaves contain bioactive compounds that help in treating cough, asthma and skin infections. The flowers are used to regulate menstrual cycles and treat hormonal imbalances. The fruit is considered nutritive and rejuvenating, improving overall immunity and strength (Bhatt *et al.* 2016). Many of the medicinal uses are experimentally proved.

Research has shown that *T. pallida* contains pregnane glycosides, which have potential therapeutic benefits (Rastogi & Mehrotra 2002). Pregnane glycosides enhance the efficacy of chemotherapy by modulating P-glycoprotein activity in cancer cells. These glycosides are believed to have anti-cancerous properties and may help in modulating the activity of P-glycoprotein, which plays a role in multi-drug resistance (MDR) in cancer treatment. Additionally, the twigs of the plant contain two newly discovered pregnane ester glycosides, pallidine and pallidine, which further contribute to its medicinal value. The plant boosts immune response by increasing white blood cell activity (Panda *et al.* 2006).



Fig. 3: Recipe made from flowers of 'Jivati' (*Telosma pallida* Craib)

The plant extracts support liver function by enhancing detoxification and protecting against hepatotoxic substances (Bhatt *et al.* 2016). It also contains flavonoids and polyphenols, which scavenge free radicals and protect cells from oxidative damage (Umaretiya *et al.* 2021). Root extract helps to reduce gastric acid secretion, providing relief in ulcer conditions. Leaf extract promotes faster wound healing by enhancing collagen formation and reducing inflammation (Bhatt *et al.* 2016). Decoctions prepared from the leaves exhibit fever-reducing effects comparable to standard anti-pyretics (Kanakhara *et al.* 2016).

Need of Conservation

Since flowers are collected, regeneration of the species is hampered; there is a risk of this plant species becoming extinct. To prevent this, it should be incorporated into cultivation practices by farmers. Considering its religious significance and nutritional value, farmers will benefit from cultivating this plant on their farms or along the fencing.

Discussion

'Waghati' (*Capparis zeylanica*) and 'Jivati' (*Telosma pallida*) both hold deep cultural significance, linked to specific seasons and rituals, while also offering considerable medicinal benefits that align not only with seasonal health concerns but also life-style diseases like diabetes.

Tradition of breaking the fast on the day after Ashadhi Eka-dashi by consuming the vegetable of 'Waghati' fruits certainly has a scientific basis. The month of Ashadh typically brings rainfall and during this period, the spread of various diseases such as diarrhoea, cough, headaches, fever and throat infections is observed more frequently. The fruits of this plant possess properties that help to reduce the impact

of these ailments. It has a bitter and astringent taste and also stimulates appetite.

'Jivati' is considered to be the Goddess of fertility and protector of children. 'Jivati' is worshipped especially in Vidarbha and Marathwada region of Maharashtra.

Pregnane glycosides present in the 'Jivati' flower contribute to its immunomodulatory, anti-inflammatory and anti-diabetic effects. The plant's traditional use in addressing cough and asthma is supported by its bioactive compounds, which directly target the respiratory system (Patil & Pawar 2018; Kanakhara *et al.* 2016).

Conclusion

The traditional use of 'Waghti' and 'Jivati' is not merely symbolic but is grounded in empirical health benefits. The cultural rituals associated with specific seasons, highlight the folk wisdom of integrating nature into both spiritual and health-related practices. However, their survival is increasingly threatened by unplanned extraction from the wild, environmental degradation and the erosion of traditional knowledge and practices. Conservation efforts must be urgently made to safeguard these valuable species. There is need to create awareness regarding cultivation, nutritional and medicinal importance of these species.

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Sweets: A glaring example of regional and cultural integration in India through the traditional and indigenous knowledge

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Abstract

Sweets are an important component in Indian diet. Interestingly, some sweets are well-known all over the country and widely consumed whereas several sweets are endemic to a particular region and less known among the rest of the country. Transmission of traditional and indigenous knowledge through the processes of migration and urbanization might be the key factors for widespread use of any particular sweet in our country. Indian sweets are glaring exhibits of regional and cultural integration which has been discussed in the article through some appropriate examples. Interestingly, many plant species are utilized to prepare the sweets and good transportation facilities have made the easy availability of those plants in areas where those are not grown naturally. The present article also enumerates 52 plant species belonging to 28 families which are used to prepare some common sweets in India. This article may prompt the scholars for conducting in-depth ethnobotanical studies to find out about the various factors and processes involved in the evolution of indigenous and traditional knowledge as well as cultural integration associated with the sweet dishes.

Key words: *Rasgulla*, Festival, Jaggery, Evolution, Urban botanical knowledge

Introduction

Sweets are usually consumed at the end of the meals. These are in fact, an essential part of Indian diet. Ancient Indian literature also refers to sweet taste as 'Madhura' in various perspectives (Sensarma 1989; Vagbhata 2015; Paria *et al.* 2014). Sweets are used to express and share happiness. In India, since from the conception of child, each and every moment of happiness whether big or small, coming across the journey of life like birth of child as welcome of a new family member, marriage, academic or other achievements, house warming, opening of new business, inaugural ceremonies, celebration of all social and National festivals etc. is expressed through sharing sweets among friends and relatives. Sweets are also shared as a return gift to friends and family members after wedding ceremony. These are also served in 'Mrtyubhoj' which is the feast offered to relatives after death of a family member in order to give satisfaction to the soul of deceased individual.

India is rich in ethnic, geographic and floristic diversity leading to diversity in food items and cuisines and almost

every region is having its own traditional recipes embedded with peculiar nutritional and cultural heritage. A traditional sweet recipe could also be observed in a small village located in the remote corner of the country (Jain 2016). Some well-known traditional sweets from Indian states are; 'Modak', 'Shrikhand' and 'Pooran Poli' of Maharashtra, 'Mysore Pak' of Karnataka, 'Pongal', 'Payasam' and 'Nankhatai' of Tamil Nadu, 'Qubani ka Meetha' of Andhra Pradesh, 'Ilayappam' and 'Payasam' of Kerala, 'Bebinca' of Goa, 'Petha' of Uttar Pradesh, 'Chenna Poda', 'Khaja' and 'Rasgulla' of Odisha, 'Makhane ki Kheer' and 'Thakua' of Bihar, 'Sandesh' from West Bengal, 'Ghevar', 'Laapsi' and 'Bhutte ka Jajariya' of Rajasthan, 'Aamras' of Gujarat, 'Pinni' of Punjab, 'Gond ke Laddu' of Haryana, 'Chakhao Kheer' of Manipur, 'Sael Roti' of Sikkim, 'Koat pitha' of Nagaland, 'Chhangban Leh Kurtai' of Mizoram, 'Khapse' of Arunachal Pradesh, 'Narikel laddu' of Assam, 'Pukhlein' of Meghalaya, 'Shufta' of Jammu and Kashmir, 'Babroo' of Himachal Pradesh, 'Bal Mithai', 'Singori', 'Jhangore ki Kheer' of Uttarakhand etc. (Website 1 and 2; Jain 2020). The spotting of such sweet-based tourist spots in a state/district through a planned ethno-cultural



tourism could be helpful for enhancing the income of local communities. Local business is also boosted, all round the year through the festivals. Various festivals are celebrated in the country throughout the year, and sweets are the most important ingredients of such celebrations. Some festivals are characterized by preparation of some specific sweets for example, 'Sattu ke laddu' and 'Maalpua' on 'Shravani Teej', 'Gujiya' on Diwali, 'Jalebi' on 'Vijayadashmi' etc. (Jain 2020; Jain 2021a). Besides, sweets prepared with age-old recipes are also part of traditional offerings to various deities for example, 'Chhappan Bhog'; a package of 56 traditional food items, is a popular offering in many temples across the country.

Traditional sweets such as various kinds of 'Laddus', 'Barfis', 'Halwas', 'Kheer' etc. exhibit India's rich cultural legacy (Sarkar *et al.* 2023). These traditional sweets are prevalent in both rural and urban communities. However, from a dozen sweets about a century ago, the creative inquisitiveness of man has led to development of more than hundred types of sweets now apparent in the country. Moreover, with the rapid urbanization, nowadays, modern sweet shops having all bakery items are observed along with traditional sweet shops in most of the Indian cities.

Men have adapted their diets as per the local climatic conditions and availability of food resources in their surroundings. Traditional recipe of preparing a food item may remain same in an area but due to processes of urbanization and migration, some modifications could be observed in preparing the same food item in other areas (Zocchi *et al.* 2024). All those dynamic changes in traditional botanical knowledge may continue for few generations leading to development of some new traditional recipes. The same could be observed in the case of sweets. Some very fine differences could be seen in preparation of a same sweet even in the same city. Not only this, but sweets are also different in their names, ingredients, taste, shape, consistency and shelf life. This variability indicates towards evolution of mankind along with the changing environment and later on becomes the cause of regional and cultural integration. Recently, Sarkar *et al.* (2023) have studied the socio-cultural aspects, processing techniques and nutritional composition of several Bengali ethnic sweetmeats and found that some of the products have undergone transformational diversification and some are rapidly disappearing due to unavailability of processing technique or raw material.

Notably, many of the sweets are prepared from plant-based ingredients and therefore, information about the plants used to prepare the sweet recipes and their cultivation and availability details should be documented. This will be useful to find out the reasons behind the widespread use of certain

sweets throughout the country in the case when the natural population of those plants is not abundant in those areas.

The present article is to make aware the scholars about one of this interesting aspect of Ethnobotany which is less explored and could be a motivating source not only for documenting various traditional and indigenous sweet dishes but also promoting them at a wider canvas to create opportunities for socio-economic upliftment of the local communities who are the real custodians and guardians of the unique bio-cultural heritage.

Plants as ingredient of Sweets

Plants are consumed as food since long time. Many indigenous recipes are prepared using different parts of plants (Parthasarathi *et al.* 2022; Waheed *et al.* 2023; Savvides *et al.* 2023). Turner (2020) has described about 50 different plant foods of indigenous people's traditional diets in northwestern North America. Similarly, every Indian state is also rich in various indigenous recipes which are prepared using several plant species (Jain 1991; Jain & Jain 2016). Recently, Kala and Nautiyal (2022) documented 41 plant species used to prepare traditional food items by the communities living in mountains of Uttarakhand, India. The predominant crop of any region has its influence on its traditional food items for example; Rice has been a major ingredient of cuisines including sweets in South India (Parthasarathi *et al.* 2022). However, with the advancement in technology and mingling of cultural groups, the novel urban botanical knowledge is arising and therefore, the need of documenting traditional food crops and food system is utmost important.

Extensive literature search, along with personal communications with persons residing in different states of the country through telephone or social media have shown that besides milk and milk products, 52 plant species belonging to 28 families are used to prepare various commonly known sweets in different parts of the country. Currently accepted botanical identities and families of those plants along with common names have been given in alphabetical order in Table 1 (Anonymous 1948-76; Website 3).

Wheat and Rice are one of the most common cereals which are utilized to prepare sweet dishes besides others like Maize. Sugarcane is one of the major sugar yielding plants providing cane sugar and jaggery as sweeteners. Among the pulses, *Cicer arietinum*, *Vigna mungo* and *Vigna radiata* could be observed as an ingredient of many of the sweets. Dry fruits and nuts are the other important ingredients utilized in several sweets.

Table 1: List of plants used as ingredient of some well-known Indian sweets

	Botanical name	Common name	English name	Plant part used
Amaranthaceae				
1.	<i>Amaranthus spp.</i>	‘Rajgira’	Amaranth grain	Seed
Anacardiaceae				
1.	<i>Anacardium occidentale</i> L.	‘Kaju’	Cashew nut	False fruit
2.	<i>Buchanania cochinchinensis</i> (Lour.) M.R. Almeida	‘Chironji’, ‘Charoli’	Cuddapah Almond	Seed
3.	<i>Mangifera indica</i> L.	‘Aam’	Mango	Fruit
4.	<i>Pistacia vera</i> L.	‘Pista’	Pistachio	Seed
Annonaceae				
1.	<i>Annona squamosa</i> L.	‘Sitaphal’	Custard Apple	Fruit
Apiaceae				
1.	<i>Daucus carota</i> L.	‘Gajar’	Carrot	Root
2.	<i>Foeniculum vulgare</i> Mill.	‘Saunf’	Anise	Seed
Arecaceae				
1.	<i>Borassus flabellifer</i> L.	‘Taarh’	Palmyra Palm	Fruit
2.	<i>Cocos nucifera</i> L.	‘Nariyal’, ‘Khopra’	Coconut	Dried endosperm
3.	<i>Phoenix dactylifera</i> L.	‘Pind-Khajur’, ‘Chuaaraa’	Date Palm	Fruit
Bromeliaceae				
1.	<i>Ananas comosus</i> Merr.	‘Annanaas’	Pineapple	Fruit
Cannabaceae				
1.	<i>Cannabis sativa</i> L.	‘Bhang’	Cannabis	Leaves
Combretaceae				
1.	<i>Terminalia anogeissiana</i> Gere & Boatwr.	‘Dhawara’	Axle wood	Gum
Convolvulaceae				
1.	<i>Ipomoea batatas</i> Lam.	‘Shakarkand’	Sweet Potato	Tuberous root
Cucurbitaceae				
1.	<i>Benincasa hispida</i> Cogn.	‘Petha’	White Pumpkin	Fruit
2.	<i>Cucumis melo</i> L.	‘Kharbuj’	Muskmelon	Seed
3.	<i>Lagenaria siceraria</i> (Molina) Standl.	‘Lauki’	Bottle Gourd	Fruit
Fabaceae				
1.	<i>Arachis hypogaea</i> L.	‘Moongphali’	Groundnut	Seed
2.	<i>Cicer arietinum</i> L.	‘Lilwa’, ‘Chana’	Gram flour & Immature green seeds	Seed
3.	<i>Trigonella foenum-graecum</i> L.	‘Methi’	Fenugreek	Seed
4.	<i>Vachillea nilotica</i> (L.) P.J.H. Hurter & Mabb.	‘Babul’	Gum Arabic	Gum
5.	<i>Vigna mungo</i> (L.) Hepper	‘Urd daal’	Black Gram	Split seed
6.	<i>Vigna radiata</i> (L.) R.Wilczek	‘Moong daal’	Green Gram	Split seed
Iridaceae				
1.	<i>Crocus sativus</i> L.	‘Kesar’	Saffron	Dried style

Juglandaceae				
1.	<i>Juglans regia</i> L.	‘Akhrot’	Walnut	Seed
Lauraceae				
1.	<i>Cinnamomum verum</i> J. Presl.	‘Daalchini’	Cinnamon	Bark
Lythraceae				
1.	<i>Trapa natans</i> L.	‘Singhara’	Trapa	Fruit
Malvaceae				
1.	<i>Theobroma cacao</i> L.	‘Cacao’	Cocoa tree	Seed
Moraceae				
1.	<i>Ficus carica</i> L.	‘Anjeer’	Fig	Fruit
Musaceae				
1.	<i>Musa</i> × <i>paradisiaca</i> L.	‘Kela’	Banana	Fruit
Myristicaceae				
1.	<i>Myristica fragrans</i> Houtt.	‘Jaiphal’ and ‘Javitri’	Nutmeg & Mace	Seed and Aril
Nymphaeaceae				
1.	<i>Euryale ferox</i> Salisb.	‘Makhana’	Fox nut	Seed
Papavaraceae				
1.	<i>Papaver somniferum</i> L.	‘Khas-khas’, ‘Postadana’	Opium, Poppy	Seed
Pedaliaceae				
1.	<i>Sesamum indicum</i> L.	‘Til’	Sesame	Seed
Phyllanthaceae				
1.	<i>Phyllanthus emblica</i> L.	‘Amla’	Indian Gooseberry	Fruit
Piperaceae				
1.	<i>Piper nigrum</i> L.	‘Kali mirch’	Black Pepper	Fruit
Poaceae				
1.	<i>Echinochloa colonum</i> Link	‘Sama’	Marsh Grass	Seed
2.	<i>Eleusine coracana</i> Gaertn.	‘Ragi’	Finger Millet	Seed
3.	<i>Oryza sativa</i> L.	‘Chawal’	Rice	Seed
4.	<i>Saccharum officinarum</i> L.	‘Ganna’	Sugarcane	Processed stem juice (sugar and jaggery)
5.	<i>Triticum aestivum</i> L.	‘Gaihun’	Wheat	Seed Split seeds
6.	<i>Zea mays</i> L.	‘Bhutta’, ‘Makka’	Corn, Maize	Seed
Rosaceae				
1.	<i>Fragaria</i> species	‘Strawberry’	Strawberry	Fruit
2.	<i>Malus domestica</i> Borkh.	‘Sev’	Apple	Fruit
3.	<i>Prunus armeniaca</i> L.	‘Khubani’	Apricot	Fruit
4.	<i>Prunus amygdalus</i> Batsch	‘Badam’	Almond	Seed
5.	<i>Rosa</i> spp.	‘Desi gulab’	Rose	Petals
Zingiberaceae				
1.	<i>Amomum subulatum</i> Roxb.	‘Bari Ilaaichi’	Greater Cardamom	Seeds
2.	<i>Elettaria cardamomum</i> (L.) Maton	‘Ilaaychi’	Small Cardamom	Seed
3.	<i>Zingiber officinale</i> Roscoe.	‘Saunth’	Dry Ginger	Rhizome
Vitaceae				
1.	<i>Vitis vinifera</i> L.	‘Daakh’, ‘Munnaka’	Raisin	Fruit

Many fruits and vegetables are also used to prepare sweet dishes for example; fruit pulp of Custard Apple is used to make 'Sitaphal Barfi' and 'Sitaphal icecream'. Use of Mango pulp for making sweet recipes like 'Aam ke papad' and 'Aamras' is also well known. Marmalades prepared from fruits of *Phyllanthus emblica*, *Malus domestica*, *Psidium guajava* and *Mangifera indica* by adding cane sugar and other ingredients are other delicacies which are sweet in taste and usually consumed with meals by rural as well as urban communities of India. Vegetables such as Bottle Gourd, Sweet Potato, Carrots, Green Gram ('Lilva') are also used to prepare 'Lauki ka Halwa', 'Shakarkand ka Halwa', 'Gajar ka Halwa', 'Lilve ki barfi' and 'Lilve ka Jaajriya', respectively. Whereas in the urban areas, sweets prepared from fruits for example, strawberry, cherry, pineapple etc. could be observed (Jain & Jain 2020). Likewise, cocoa powder; obtained from seeds of *Theobroma cacao*, is frequently utilized to prepare many modern sweets including chocolate shakes, cookies, ice-creams, puddings, cakes, brownies, etc. which indicates towards adaptation of cross-cultural botanical knowledge leading towards development of novel urban botanical knowledge.

Sesame seeds are important ingredients of many traditional winter sweets such as 'Gajak', 'Chikki', 'Jagal' and 'Rewri'. Likewise, Poppy seeds are used to prepare 'Posta-dana halwa' and added in other sweets such as 'Raskadam', 'Kheer' and 'Gajar ka halwa'. Use of fruits of *Phyllanthus emblica* for making 'Laddus' and candy is another interesting aspect of preparing nutritious sweets from plants (Jain 2020; Jain 2021b; Sarkar *et al.* 2023).

Sweets as an example of regional and cultural integration

Some of the traditional sweets are still endemic to a particular region and some have spread across the country. For example, 'Ilayappam' of Kerala is still restricted to Kerala whereas 'Rasgulla' from Odisha and West Bengal is well-known in the entire country. 'Rasgulla' has entered from far eastern parts of country to western parts such as in Rajasthan and now famous through Bikaner, a district in Rajasthan as 'Bikaneri Rasgulla'. This might have occurred due to migration of many Marwari traders from Bikaner to Kolkata for business purpose and in return, they may have brought back the recipe of 'Rasgulla' to Bikaner. Besides, many sweets are so widespread and it seems that boundaries of their origin have lost in trough of time and now it is tough to find the regions of their origin. Some such sweets are 'Balushahi', 'Gulabjamun', 'Chawal ki Kheer', 'Kaju ki barfi', 'Besan ke laddu', 'Gajar ka Halwa' and many others. This shows the regional and cultural integration through

spread of traditional and indigenous knowledge.

Sweets are not only part of diets of urban population but people living in forests and rural areas also enjoy eating sweets. Several indigenous sweets and beverages are consumed by tribal and rural populations. Some of which are documented (Jain 1991; Jain & Jain 2016; Parthasarathi *et al.* 2022; Sarkar *et al.* 2023) and some still requires extensive field studies. Interestingly, migration of that indigenous knowledge to urban cities and towns has become an important source of regional integration. For example, a sugar block made from *Phoenix sylvestris* known as 'Patali' in eastern India has even crossed the boundaries of tribal population and being sold in the urban markets (Basu & Mondol 2015). Advancement in transportation and storage facilities, led to shorten the geographical boundaries and a plant part growing in a distant area is being used at a far distant place for example, Saffron produced in Jammu & Kashmir is used in western or southern Indian states. These factors also accelerate regional and cultural integration.

It is recommended that every region of the country could be explored to find out the traditional and indigenous sweet recipes of that area. Climate, availability and accessibility of edible ingredients as well as nature of occupation affect dietary habits of communities. Urbanization, migration and pluricultural background also plays an important role in evolution of novel recipes. A complete picture about use pattern of various sweet dishes could be derived when impact of these factors too will be studied in detail.

Therefore, in-depth cross-cultural and inter-state ethnobotanical studies are required addressing the questions such as how the difference in local communities, topography and vegetation affects the choice of sweet dishes and processing techniques; role of migration in exchange of botanical knowledge; major factors behind widespread popularity of any particular sweet; effect of context in survival of a tradition in a new place; and many more intricacies. Moreover, how sweets can play role in socio-economic upliftment of the original knowledge holder communities is another important aspect of such studies. A scientific database of ethnic sweets could be prepared depicting their origin, processing method and nutritional composition and with that a gastronomic tourism route could be developed. Moreover, the cultivation of raw materials used for preparation of sweets could help in protection of traditional agro-biodiversity as well as help in regional integration and promoting sustainable food production. It is hoped, that the present article will stimulate scholars to further explore the role of traditional and indigenous knowledge on recipes of sweets in promoting regional and cultural integration.

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Ethnomedicinal plants used as toothbrush by Bhil tribe of Ratlam district (Madhya Pradesh)

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Abstract

The present paper provides the information on some ethnomedicinal plant species used as toothbrush to cure toothache covering an area inhabited by Bhil tribe of Ratlam district (MP). It deals 8 plant species under 7 genera belonging to 7 families. The botanical names followed by local names, family and plant part used as toothbrush is mentioned.

Key words: Bhil, Ethnomedicinal plants, Toothbrush, Ratlam district, Madhya Pradesh

Introduction

Aboriginals possess profound knowledge about the properties and uses of plants inhabiting in their surroundings. They have inherited rich traditional knowledge of surrounding plants. Such knowledge of economic and other properties of surrounding plants acquired by the tribal community by virtue of their experience and practice has been passed on from generation to generation as a part of their cultural heritage. These people still practice the herbal medicines for the treatment of their daily routine ailments (Jain 1981, 1991, 2002, 2004). The knowledge of these medicines is age old. For them, use of local herbs is the cheapest way for getting the treatment of various health disorders. So far, there is no government clinic in their inhabited localities. The major driving force for the use of herbal drugs is the perception that these herbal drugs are natural and safe and have no side effects. In India, plants have been used as natural toothbrush since very long time. Plants used as toothbrush found throughout India. It is used by the native peoples as a chew stick for cleaning their teeth. In ancient Indian system of traditional medicine Ayurveda, many plant species are described with their medicinal properties and uses to cure toothache (Sikarwar *et al.* 2020, Singh *et al.* 2013). Today people are very much concerned about maintenance of their physical health. Stress, strain and anxiety have gifted mankind with many life style related disorders among which toothache is the most common. Faulty food habits are the key factors for causing and complicating the pathogenesis of toothache. Some ethnomedicinal plants used as toothbrush

by Bhil tribe of Ratlam district (MP) have been found to be very effective for the treatment of toothache.

During extensive field trips in some tribal inhabited villages of the district, the author recorded new and interesting ethno-medicinal uses of plants in the surrounding used by the tribals. The author is engaged in ethnomedicinal investigations in this district, results of which have been published (Jadhav 2016; 2017; 2018; 2019) earlier. This paper is in link of the same work. The present paper provides the information on some ethnomedicinal plants used as toothbrush effectively used to cure toothache by Bhil tribe of Ratlam district (MP).

Study Area

Ratlam district lies in the western part of the Malwa Plateau in Madhya Pradesh. The mathematical limits of the district extend from 23° 05' North to 23° 55' North and from 74° 30' East to 75° 42' East. The district comprises an area of 4861 sq. km inhabited by 1,455,069 persons, living in 1080 villages covering 8 tehsils Viz. Alot, Bajna, Jaora, Piploda, Ratlam, Rawti, Sailana and Tal (Census 2011). Bhils are the main inhabitants of different villages of the district. According to 2001 census the population of Bhil tribe in the district was 2.26 lac constituting about 23.27% of the total population.

The forests, which occupy a total area of 499.92 sq km or 10.26%, are of the dry deciduous Vb type (Champion



and Seth 1968). The forests are dominated by Teak (*Tectona grandis* L.f.). In Ratlam district there are two important rivers, namely, the Chambal flowing north along with its tributaries and the Mahi flowing to the north-west. The climate of the State is generally sub-humid with an annual rainfall ranging from 700-1200 mm. The minimum and maximum temperatures range between 6⁰ C and 43⁰ C in the months of January and May, respectively. The black cotton soil predominates the entire district.

Methodology

Extensive field trips were organized for collecting the plant species and data using an integrated approach of botanical collections interviews and questionnaires. In Bhil tribe or village usually, there is one elder person familiar with the use of surrounding plants, and is local physician who is called “Bhopa” (Traditional rural medicine men). “Bhopa” was contacted and taken to the field for collecting information about ethnomedicinal plants which are used as toothbrush in the treatment of toothache, their local name, parts used. Herbarium specimens prepared following the standard method (Jain and Rao 1978) have been deposited in the herbarium of Botany department, Arts & science college, Ratlam (M.P.). Herbarium specimens were identified with the help of standard Floras (Mudgal *et al.* 1997; Singh *et al.* 2001; Verma *et al.* 1993).

Enumeration

Plant species are enumerated alphabetically with their botanical names, family, local names and folklore claims:

S. No.	Botanical names	Family	Local names	Ethnomedicinal Uses
1.	<i>Acacia nilotica</i> (L.) Willd. ex Delile ssp. <i>indica</i> (Benth.) Brenan.	Mimosaceae	‘Bawer’	The tender twigs are used as tooth-brush to cure toothache.
2.	<i>Achyranthes aspera</i> L.	Amaranthaceae	‘Andijhaddo’	The stem is used as toothbrush in the cases of bad breath.
3.	<i>Azadirachta indica</i> A. Juss.	Meliaceae	‘Limdo’	The tender twigs are used as tooth-brush to cure toothache.
4.	<i>Ficus benghalensis</i> L.	Moraceae	‘Vadlo’	Adventitious roots are used as tooth-brush to cure toothache.

5.	<i>Ficus racemosa</i> L.	Moraceae	‘Gulri’	The tender twigs are used as tooth-brush to cure toothache.
6.	<i>Jatropha curcas</i> L.	Euphorbiaceae	‘Ratan-jot’	Twigs are used as toothbrush to cure toothache.
7.	<i>Mangifera indica</i> L.	Anacardiaceae	‘Ambo’	The tender twigs are used as tooth-brush to cure toothache.
8.	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	‘Lapti’	The stem is used as tooth-brush to cure toothache.

Results

The paper provides ethnomedicinal uses of eight (8) ethnomedicinal plants as toothbrush by Bhil tribe of Ratlam District (MP) for the treatment of toothache. Some of these types of medicines i.e. folk medicines got incorporated in the organized systems of medicine, but a large number of folk medicines remained endemic to certain regions in our country. The knowledge of folk medicines acquired by the local inhabitants through experience of ages and passed on the word of mouth from generation to generation as a part of their cultural heritage. In this context the ethnomedicinal survey is very important. The survey will not only lead to discovery of new medicinal plants but also result in better understanding of the relationship between the local inhabitants or community group and the modern science. The benefit of indigenous knowledge can be harnessed and improved upon by its appropriate use, establishing validity of such knowledge and integrating it with health care programs. These ethno-medicinal data also provide baseline information to start the search for new compounds related to phytochemistry, pharmacology and pharmacognosy. These ethno-medicinal researches help us in developing novel drug formulations to cure certain ailments. This valuable ethnomedicinal knowledge of tribes needs to be preserved before it is eroded from the memory. These studies of traditional plant lore pave the way for discovering new drugs for the welfare of mankind.

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Ethnomedicine for leprosy and ringworm by the tribes of Khammam district, Andhra Pradesh

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Abstract

The paper deals with 25 species of plants used by the tribes of Khammam district, Andhra Pradesh for curing leprosy and ringworm. Fabaceae is the dominant family and 14 practices were found to be new.

Key words: Konda Reddi, Leprosy, Ringworm, Khammam district, Andhra Pradesh

Introduction

Khammam district is surrounded by Chhattisgarh and Orissa states in the North, Krishna district in the South, East and West Godavari districts in the East and Nalgonda and Warangal districts in the West. It lies between 16⁰⁰ 45' and 18⁰⁰ 35' N latitude and 79⁰⁰ 47' to 81⁰⁰ 47' E longitude occupying an area of 16, 029 sq km with a total forest area of 7, 594.38 sq km.

The tribal population of India is 8.2%. The tribes constitutes 7.0% of the total population of Andhra Pradesh (Census 2011). Khammam district with 26.47% tribal population stands first in the state and is the home of six tribal communities, viz., Koya, Lambada, Gond/Naikpod, Yerukula, Nayak and Konda Reddi. Though there are publications on ethnomedicine dealing with a variety of diseases viz., asthma, cold and cough, cuts and wounds, diabetes, dysentery and diarrhea, eye problems, fever, hemorrhoids, kidney stones, menstrual disorders, rheumatism, sexually transmitted diseases, skin diseases, tumors, and urinary complaints (Upadhyay & Chauhan 2000; Raju & Reddy 2005; Manjula *et al.* 2013 a,b,c,d,e,f; 2014 a, b; 2015; Manjula & Reddi 2015, 2016, 2017a,b; 2020), not much information is available on leprosy and ringworm necessitating the present study.

Materials and Methods

Ethnobotanical survey was conducted in tribal rich habitations of Khammam district once in every two months from

2008 to 2012 with a duration of 10-15 days. About 4-7 days were spent during each trip with Koya, Lambada, Gond/Naikpod, Yerukula, Nayak and Konda Reddi tribes at their dwellings in the forests. After establishing good rapport with the tribes, the utility of plants and detailed methods of uses were documented. In 102 pockets of the study area, 102 *vaidyas* and practitioners were consulted. Data collected were cross checked for authenticity. Voucher specimens were collected in both flowering and fruiting stages, herbarium specimens were prepared and deposited in the Botany Department Herbarium (AUV), Andhra University, Visakhapatnam, after identification.

Enumeration

The plants are enumerated alphabetically with valid botanical name followed by family, vernacular name along with the tribe, English name (E), locality, collector name and voucher number. Each ethno-medicinal practice is provided with the part(s) used, method of preparation, mode of administration and dosage. Plants and practices marked with an asterisk (*) are considered to be new or less known.

Acacia catechu (L. f.) Willd. (Fabaceae) 'Sandra' (Konda Reddi), E: Cutch tree, Bethampudi, RRM 10000

Leprosy: Ten ml of stem bark decoction is administered thrice a day for one month.



Acacia polyacantha (Willd.) Seigler & Ebinger (Fabaceae) ‘Tellakachu’ (Gond), E: White cutch tree, Bayyaram, RRM 10030

***Leprosy:** Twenty ml oil extracted from seeds is given twice a day for 30 days.

Argyreia nervosa (Burm. f.) Bojer (Convolvulaceae) ‘Samudrapala’(Koya), E: Elephant creeper, Yetapaka, RRM 10107

***Ringworm:** Leaf paste is applied on the affected areas till cure.

Aristolochia indica L. (Aristolochiaceae) ‘Nalla eeswari’ (Gond), E: Indian birth wort, Mothugudem, RRM 10108

***Leprosy:** Two spoonful of root powder mixed with one spoonful of black pepper powder is administered along with a cup of water twice a day for 30 days.

Barleria prionitis L. (Acanthaceae) ‘Gobbi’ (Konda Reddi), E: Thronnail dye, Marri Gudem, RRM 10071

***Ringworm:** Leaf paste is applied on the affected areas once a day till cure.

Butea monosperma (Lam.) Kuntze (Fabaceae) ‘Moduga’(Naikpod), E: Flame of the forest, Thungaram, RRM 10116

***Leprosy:** A pit is dug near the trunk of the tree so as to locate the root. To the cut root a small earthen pot is tied. Around the tree trunk rice hay is spread and burnt. It enables oozing of sap from the root into the pot. Ten ml of juice is administered once a day till cure.

Cassia absus L. (Fabaceae) ‘Kantri senna’ (Lambada), E: Pigs senna, Venkatapuram, RRM 10048

Ringworm: Seed paste is applied on the affected areas once a day for ten days.

Cassia alata L. (Fabaceae) ‘Seema mettathamara’ (Koya), E: Ring worm cassia, Seripuram, RRM 10080

Ringworm: Leaves are crushed with rock salt and made into juice is applied on the affected areas twice a day till cure.

Cassia tora L. (Fabaceae) ‘Adavi menthulu’ (Yerukula), E: Foetid cassia, Lakshmipuram, RRM 10081

Ringworm: Leaf paste is applied on the affected areas twice a day for ten days.

Cordia dichotoma (Ruiz & Pav.) Gurke (Boraginaceae) ‘Eriki’ (Konda Reddi), E: Indian cherry, Parnasala, RRM 10191

***Ringworm:** Seed powder mixed with coconut oil is applied on the affected areas once a day till cure.

Croton bonplandianus Baill. (Euphorbiaceae) ‘Kukkutulasi’ (Koya), E: Three- leaved caper, Yerram Padu, RRM 10131

***Ringworm:** Leaf paste mixed with lemon juice is applied twice a day for 15 days.

Cullen corylifolium (L.) Medik. (Fabaceae) ‘Bavan-chalu’(Nayak), E: Babchi, Enkuru, RRM 10509

Leprosy: Five gm of seed powder is taken with a cup of water daily once till cure.

Ringworm: Whole plant paste is applied on the affected areas once a day till cure.

Curcuma caesia Roxb. (Zingiberaceae) ‘Nalla pasupu’ (Konda Reddi), E: Black zedoary, Thaliperu, RRM 10257

***Leprosy:** One gm of rhizome powder mixed with a cup of water is administered once a day for 40 days.

Holarrhena pubescens Wall. ex G. Don (Apocynaceae) ‘Pala’ (Gond), E: Ivory tree, Yetapaka, RRM 10218

Leprosy: Seed paste is applied on the affected areas twice a day till cure.

Jasminum angustifolium (L.) Willd. (Oleaceae) ‘Adavimalle’ (Lambada), E: Wild jasmine, Singabhupalem, RRM 10247

Ringworm: Leaf juice mixed with lemon juice is applied on the affected areas once a day till cure.

Lablab purpureus (L.) Sweet (Fabaceae) ‘Chikkudu’ (Yerukula), E: Indian butter bean, Nimmagadda, RRM 10240

***Ringworm:** Leaf juice is applied on the affected areas twice a day for ten days.

Melia azedarach L. (Meliaceae) ‘Turakavepa’ (Konda Reddi), E: Persian lilac, Chikupalli, RRM 10374

Leprosy: Thirty ml of root bark decoction is administered with a pinch of turmeric powder twice a day for 90 days.

Moringa oleifera Lam. (Moringaceae) ‘Munaga’ (Lambada), E: Drumstick, Vajedu, RRM 10307

Table 1: Some plants of Khammam district, Andhra Pradesh used for similar purpose in India, Pakistan, Philippines and Nigeria.

S. No.	Plant species	Tribes/Area/Region/Country	Reference(s)
1.	<i>Jasminum angustifolium</i>	Yanadi, Nakkala, Irula, Yerukala, Sugali tribes of Chittoor district, Andhra Pradesh	Vedavathy <i>et al.</i> (1997)
2.	<i>Cassia tora</i>	Machhi, Koli, Tandel, Bhandari, Dubia, Kunbi, Rohit tribes of South Gujarat Tribals of Gujarat and Maharashtra Kalahandi district of Orissa People in 10 southern and one northern districts of Karnataka Mandi district of Himachal Pradesh Agaria, Baiga, Basor, Bharia, Bhil, Gond, Halba, Kondar, Korku, Pao, Madia, Mawasi, Mobasi, Oruooan, Sahariya, Sor tribes of Madhya Pradesh	Kshirsagar <i>et al.</i> (2003); Parabia & Pathak (2008); Panda & Padhy (2008); Shiddamallayya <i>et al.</i> (2010); Sen & Samant (2013); Jadhav (2020a)
3.	<i>Melia azedarach</i>	Ethnic groups–Baloch, Cheena, Bhidwal, Jhamat, Rajput of Bhakkar district, Punjab, Pakistan.	Shah (2005)
4.	<i>Acacia catechu</i> , <i>Cassia alata</i> , <i>Jasminum angustifolium</i> , <i>Piper nigrum</i> , <i>Thespesia populnea</i>	Paniya, Kuruma, Adiyar, Kurichya, Oorali, Kattanaikan, Kadan tribes of Wayanad district, Kerala	Nisha & Sivadasan (2007)
5.	<i>Cassia alata</i>	Folklore of Edo States in Nigeria	Idu <i>et al.</i> (2008)
6.	<i>Cordia dichotoma</i>	Tribes of Sikkim, Himalaya Folklore of Jharkhand Baiga tribe of Dindori district, Madhya Pradesh. Nyishi tribe of Pakke-Kessang district of Arunachal Pradesh. People of Cavite, Philippines.	Tripathi <i>et al.</i> (2009); Siddiqui (2010); Ahirwar (2017); Balakrishna <i>et al.</i> (2021); Caunca & Balinado (2021)
7.	<i>Acacia catechu</i> , <i>Cassia tora</i>	People of Guntur district, Andhra Pradesh.	Babu & Ammani (2010)
8.	<i>Acacia catechu</i> , <i>Holarrhena pubescens</i> , <i>Moringa oleifera</i>	Folklore of Madhya Pradesh	Jadhav (2017)
9.	<i>Holarrhena pubescens</i>	Folklore of Chitrakoot region of Madhya Pradesh	Tripathi <i>et al.</i> (2018)
10.	<i>Acacia catechu</i> , <i>Butea monosperma</i> , <i>Cordia dichotoma</i> , <i>Holarrhena pubescens</i> , <i>Melia azedarach</i> , <i>Moringa oleifera</i>	People of Madhya Pradesh	Jadhav (2020b)

***Ringworm:** Fine paste of root is applied on the affected areas once a day till cure.

***Ocimum tenuiflorum* L.** (Lamiaceae) ‘Krishna tulasi’ (Lambada), E: Holy basil, Thaliperu, RRM 10233

***Ringworm:** Leaf paste mixed with salt is applied on the affected areas once a day till cure.

***Piper nigrum* L.** (Piperaceae) ‘Miriyalu’ (Yerukula), E:

Black pepper, Lakshmipuram, RRM 10334

***Ringworm:** Seed powder mixed with coconut oil is applied on the affected areas till cure.

***Pterocarpus santalinus* L.f.** (Fabaceae) ‘Erra-chandhnamu’ (Naiakpod), E: Red sanders, Mothu Gudem, RRM 10399

Leprosy: One spoonful of stem bark paste mixed with cup of water is administered twice a day till cure.

Sphaeranthus indicus L. (Asteraceae) ‘Bodasaramu’ (Konda Reddi), E: East Indian globe thistle, Tekulapalem, RRM 10410

Ringworm: Whole plant juice is applied with a pinch of salt once a day till cure.

Thespesia populnea (L.) Sol. ex Correa (Malvaceae) ‘Gangaravi’ (Yerukula), E: Portia tree, Bhadrachalam, RRM 10504

Ringworm: Seed paste is applied on the affected areas twice a day till cure.

Triumfetta rhomboidea Jacq. (Tiliaceae) ‘Chiru sitrika’ (Konda Reddi), E: Bur weed, Charla, RRM 10520

***Leprosy:** Twenty ml of flower decoction is taken twice a day till cure.

Wrightia tinctoria (Roxb.) R. Br. (Apocynaceae) ‘Ankudu’ (Gond), E: Sweet indrajao, Peruru, RRM 10471

***Ringworm:** Leaves pestled with that of *Cassia occidentalis* are applied on the affected areas once a day till cure.

Results and Discussion

The paper deals with 25 species of plants covering 22 genera and 13 families used by the tribes of Khammam district, Andhra Pradesh for curing leprosy and ringworm. Fabaceae is the dominant family with 9 species followed by Apocynaceae (2 spp.) and others with one species each. Trees are dominant with 10 species followed by shrubs (6 spp.), climbers (5 spp.) and herbs (4 spp.). Leaf is used in a maximum of 9 practices. Fourteen practices were found to be new or less known (Jain 1991, Kirtikar and Basu 2003). Plants used for similar purpose in different parts of India, Pakistan, Philippines and Nigeria are presented in Table -1.

The cultivation of medicinally important plants by the local tribes is one of the best options that can help in the conservation of plant diversity in general and medicinal plants in particular, meeting market demand and also providing an additional source of livelihood to the local inhabitants. Bio-prospecting of medicinal plants for new drug development are urgently required for the conservation and sustainable management of medicinal plants of Khammam district of Andhra Pradesh.

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स्तन कैंसर से सुरक्षा: एक वनस्पतिशास्त्री की कहानी (तालीशपत्र)

डॉ. सैंड्रा डाइन नैप (सैंडी) एवं केट पैविड

अनुवाद एवं संकलन: संजीव कुमार ओझा एवं अनिल कुमार गोयल
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Protection Against Breast Cancer: A Botanist's Story (Talish Patra)

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Abstract

This article is based on a firsthand account by Dr. Sandy Knapp, an American-born botanist and a distinguished researcher at the Plants Division of the Natural History Museum, London (UK), who served as President of the *Linnean Society* of London since 2018.

Her strong commitment towards conservation of plants, nature, and plant species, and then fighting with breast cancer by using these plant-based medicines as a weapon, and her mindset towards life again, can be inspirational for anyone/many.

In this context, an effort has been made to convey Dr. Sandy's story to the general public in their own language. Additionally, a brief attempt has been made to explain the differences between plants with similar names in Indian medicine.

Key words: Breast Cancer, Taxol, Paclitaxel

सारांश

यह लेख अमेरिका में जन्मी वनस्पतिशास्त्री और नेचुरल हिस्ट्री म्यूजियम, लंदन के पादप प्रभाग (Plants Division) में प्रतिष्ठित शोधकर्ता डॉ. सैंडी नैप के प्रत्यक्ष वृत्तांत (firsthand account) पर आधारित है, जिन्होंने 2018 से लिनियन सोसाइटी ऑफ लंदन की अध्यक्ष के रूप में अपनी सेवाएँ दी।

पौधों, प्रकृति और पादप प्रजातियों के संरक्षण के प्रति उनकी दृढ़ प्रतिबद्धता, और फिर पादप-आधारित औषधियों को हथियार बनाकर स्तन कैंसर से उनकी लड़ाई, और जीवन के प्रति उनका अटूट संकल्प, हर किसी के लिए प्रेरणा का स्रोत हो सकता है। इसी संदर्भ में, डॉ. सैंडी की कहानी को आम जनता तक उनकी अपनी भाषा में पहुँचाने का एक प्रयास किया गया है। साथ ही, भारतीय चिकित्सा पद्धति (आयुर्वेद) में समान नाम वाले पौधों के बीच के सूक्ष्म अंतर को स्पष्ट करने का भी प्रयास किया गया है।

प्रमुख शब्द: स्तन कैंसर, टैक्सोल, पैक्लिटेक्सेल



डॉ सैंडी नैप की आपबीती

वनस्पति विज्ञानी डॉ सैंडी नैप ने लगभग 40 वर्षों तक पौधों का अध्ययन किया। जिस समय उन्हें स्वयं के स्तन कैंसर का पता चला, उस समय वे उस प्राकृतिक जगत से अच्छी तरह परिचित हो चुकी थी और इसी ज्ञान ने उनकी जान बचाई।

डॉ सैंडी नैप, खाद्य पौधों के क्षेत्र में वैश्विक विशेषज्ञों में से एक हैं और संग्रहालय में पादप विभाग का नेतृत्व करती रहीं। उन्होंने दशकों तक अध्ययन किया है कि वे कैसे बढ़ते और फलते-फूलते हैं तथा कैसे वे हमारे शरीर का भरण-पोषण करते हैं।

डॉ सैंडी ने अपना सम्पूर्ण जीवन, पूरी दुनिया के मंचों पर, प्रकृति व पौधों की प्रजातियों के संरक्षण की हिमायत करते हुये बिताया। सन 2018 में, जब उन्हें कैंसर का पता चला तो यह समय प्रकृति द्वारा उनके परिश्रम का फल देने का था। वास्तव में महान प्राकृतिक विविधता शब्दतः उनकी सहायक बन गई, जैसा कि मूल रूप से उनका इलाज पेड़ों और मिट्टी से प्राप्त दवाओं के साथ किया गया।

अक्टूबर 2018 में डॉ सैंडी ने एक महत्वपूर्ण विदेश यात्रा की, जिसमें बोस्टन में एक संग्रहालय की समीक्षा कार्य हेतु, मिसौरी (Missouri) में एक हर्बेरियम की यात्रा और इक्वाडोर (Ecuador) में एक सम्मेलन में भाषण दिया। लगभग आधी यात्रा के पश्चात उन्हें अपने स्तन में एक गांठ का पता चला। वह कहती हैं, मैंने सोचा कि यह कुछ खास नहीं है और सफर जारी रखा, लेकिन फिर भी एहतियातन अपने डॉक्टर को फोन किया और वापस आने पर मैंने मिलने का समय लिया। वापस आने पर



डॉ. सैंडी नैप, मेधावी वैज्ञानिक,
नेचुरल हिस्ट्री म्यूजियम, लंदन, इंग्लैंड

मुख्य बिंदु (Key Points)

- मनसुख वानी और मोनरो वॉल ने पैक्लिटैक्सेल की खोज की, जो पैसिफिक यिव ट्री की छाल से एक जीवनरक्षक यौगिक है।
- नेशनल कैंसर इंस्टीट्यूट (एनसीआई) से अनुदान प्राप्त शोधकर्ताओं ने कैंसर के इलाज के लिए पैसिफिक यिव ट्री की क्षमता को उजागर किया और जीवन रक्षक यौगिक पैक्लिटैक्सेल (टैक्सोल) विकसित किया।
- टैक्सोल, कैंसर का इलाज करने के लिए इस्तेमाल किया जाने वाला एंटीमायोटिक एजेंट, कोशिका विभाजन को रोककर कैंसर के विकास को रोकता है, जिसके परिणामस्वरूप कोशिका मृत्यु होती है।
- एक एनसीआई एवं वित्तपोषित क्लिनिकल परीक्षण में पाया गया कि उन्नत डिम्बग्रंथि के कैंसर वाले 30 प्रतिशत रोगियों ने टैक्सोल उपचार के लिए सकारात्मक प्रतिक्रिया दी।
- वर्तमान में टैक्सोल विश्व स्वास्थ्य संगठन की आवश्यक दवाओं की सूची में है यह एक साइटोटॉक्सिक दवा के रूप में कैंसर कोशिकाओं को मारता है। इसका उपयोग स्तन कैंसर, डिम्बग्रंथि के कैंसर, फेफड़ों के कैंसर, अग्नशय के कैंसर और एड्स से संबंधित कापोसी साकार्मा के इलाज के लिए किया जाता है।

डॉक्टर द्वारा मुझे शीघ्र ही सीधे अस्पताल के लिए रेफर कर दिया गया। यह जानकर मुझे झटका लगा कि “चिंता की कोई बात नहीं” वाली गांठ, संभवतः अत्यंत घातक थी। एनएचएस (NHS & National Health Service in England), यह एक विशालकाय राष्ट्रीय स्वास्थ्य व्यवस्था है, जो तत्काल हरकत में आया और चिकित्सा प्रारम्भ हो गयी।

कुछ सप्ताह पश्चात डॉ सैंडी अपनी मित्र वनेसा के साथ अपने चिकित्सक के पास लौट आईं। जांच में त्रि-ऋणात्मक स्तन कैंसर (triple negative breast cancer) था जिसमें हार्मोन थेरेपी कारगर (प्रभावी) नहीं होती है, अतः इसके उपचार के लिए कीमोथेरेपी के बाद सर्जरी और रेडियोथेरेपी चिकित्सा की व्यवस्था निर्धारित हुयी। अचानक ही पूरे जीवन में परिवर्तन लाने वाली इस गंभीर बीमारी के पता चलने के कुछ ही दिनों बाद, अपने डॉक्टरों की

काम में व्यस्त रहने की सलाह पर डॉ. सैंडी ने अगले ही दिन प्रकृति के संरक्षण हेतु केन्या के एक अलाभकारी संगठन ओल पेजेटा कन्जर्वेन्सी (*Ol Pejeta Conservancy*) के लिए उड़ान भरी। चूंकि एक हफ्ते तक इलाज में कुछ नहीं होने वाला था, और वह घर पर रहकर अपनी इस स्थिति और इसके इलाज के बारे में सोचकर अवसादग्रस्त हो सकती थी। उनका मानना है कि जिस प्रकृति को उन्होंने देखा, उससे उन्हें बाद में स्तन कैंसर के इलाज के लिए तैयार होने में मदद मिली। वह कहती हैं, यद्यपि मेरी यात्रा केवल चार दिनों की थी, किंतु यह मेरे अब तक के सबसे श्रेष्ठ निर्णयों में से एक सिद्ध हुई।

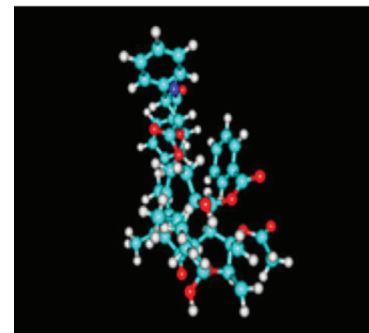
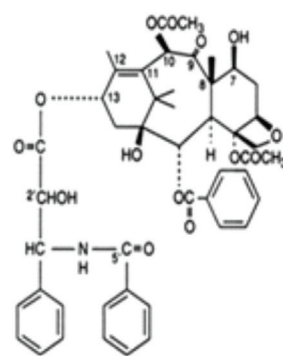
केन्या में जंगली पौधों और जानवरों को ऐसे क्षेत्र में देखने जाना, जहां वन्य जीवन और लोगों की आजीविका दोनों की रक्षा के लिए नवीन संरक्षण प्रथाओं का उपयोग किया जा रहा है, मेरे जीवन को खुशी प्रदान करने वाला था। मुझे सच में लगता है कि, अफ्रीका में प्राकृतिक जगत के साथ मेरे अनुभव ने, मुझे मानसिक रूप से कठिनाइयों को सहने के लिए तैयार किया। बहुत सारे आंकड़े बताते हैं कि प्रकृति - लोगों की भलाई और मानसिक स्वास्थ्य में सुधार कर सकती है, और वास्तव में मैं भी कह सकती हूं कि मुझे पता है कि इसने मेरे लिए कार्य किया।

ब्रिटेन में वापस आने पर उपचार अपनी पटरी पर आ गया। उन्हें एक क्लीनिकल ट्रायल में चयनित किया गया और पांच महीने की कीमोथेरेपी (एक ऐसा उपचार जो कैंसर कोशिकाओं को रासायनिक औषधियों से नष्ट किया जाता है) के साथ आगे बढ़ी। डॉ. सैंडी को दो अलग अलग कीमोथेरेपी औषधियाँ प्रदान की गयी, दोनों में प्रकृति से प्राप्त यौगिक शामिल थे। जिनमें पैक्लिटेक्सेल (Paclitaxel) और कार्बोप्लाटिन (Carboplatin) नामक दो औषधियाँ का संयोजन था।

तालीशपत्र - पैसिफिक यिव ट्री (टैक्सस ब्रेविफोलिया) Pacific yew tree (*Taxus baccata* syn- *T. brevifolia*), जिससे कैंसर से लड़ने वाली दवा टैक्सोल (Taxol) मूल रूप से आती है। यद्यपि, डॉक्टर सिंथेटिक विकल्प का उपयोग करते हैं। पैक्लिटेक्सेल टैक्सोल के यौगिकों में से एक है जिसे मूल रूप से पैसिफिक यिव ट्री (*टैक्सस ब्रेविफोलिया*) की छाल से निकाला गया था।

टैक्सोल एक जीवनरक्षक औषधि है जो कैंसर कोशिकाओं को विभाजित होने से रोकती है। इसकी खोज 1960 के दशक में

अमेरिकी राष्ट्रीय कैंसर संस्थान ने अमेरिकी कृषि विभाग के साथ भागीदारी में प्राकृतिक पौधों और जैव उत्पाद द्वारा कैंसर के सम्भावित इलाज पर कार्य करते हुए किया था। 1960 और 1981 के बीच शोधकर्ताओं ने इस कार्यक्रम के तहत 30,000 नमूनों का परीक्षण किया और पाया कि पैसिफिक यिव ट्री के अर्क जीवित कोशिकाओं के लिए विषाक्त थे। वर्षों के क्लिनिकल परीक्षण के बाद, उन्होंने यौगिक का एक



Paclitaxel Structure

सिंथेटिक कंपाउंड विकसित किया जो पेड़ों को नुकसान से बचाता है। टैक्सोल अब विश्व स्वास्थ्य संगठन की आवश्यक दवाओं की मॉडल सूची में है, और यह अभी भी उपलब्ध सर्वोत्तम पौधों पर आधारित कैंसर उपचारों में से एक है। इसका उपयोग स्तन, डिम्बग्रंथि, फेफड़े और अग्न्याशय के कैंसर और एड्स से संबंधित कपोसी साकार्मा के इलाज के लिए किया जाता है।

इस औषधि के लिए प्रारंभिक उत्साह बहुत अधिक था और उस दर से इसका उत्पादन करने पर एक एकल खुराक के लिए पूरे पेड़ की छाल की आवश्यकता पड़ती। अतः यह स्पष्ट हो गया कि इस स्रोत से दवा का उत्पादन जारी रखने से उक्त पेड़ विलुप्त हो जाएगा। सौभाग्य से, एक समाधान तब आया जब यह पाया गया कि **यूरोपीय यिव (टैक्सस बकाटा)** का संश्लेषण करके उसे अंतिम उत्पाद में परिवर्तित किया जा सकता है।

डॉ. सैंडी बताती हैं, 21 हफ्तों तक कीमोथेरेपी में इन दवाओं को सतर्क और दयालु नर्सों की दैनिक देखभाल में दिया गया। उधर संग्रहालय ने भी मुझे संरक्षण और सहयोग प्रदान किया। मैं काम न करने का सामना नहीं कर सकती थी, इसलिए मैंने विश्राम की जगह पूरे समय घर से काम करने का निश्चय किया।

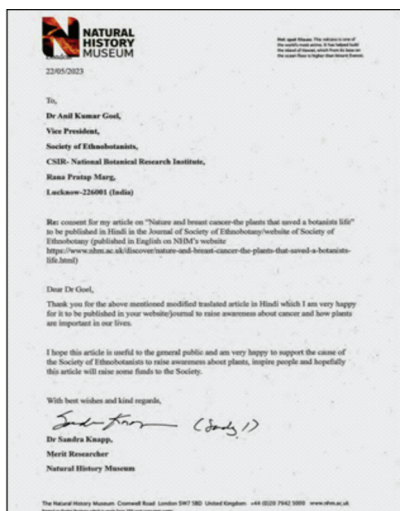
डॉ. सैंडी आभार व्यक्त करते हुए कहती हैं कि मेरे सहयोगियों और परिवार ने यह सुनिश्चित किया कि मैं कभी भी कीमोथेरेपी

के लिए अकेले न जाऊं, जिसके लिए मैं बहुत आभारी हूं। डॉ. सैंडी ने भी अपनी कीमोथेरेपी के दौरान बालों के झड़ने के आम दुष्प्रभाव और बीमारी का अनुभव किया। कीमोथेरेपी ने अपना काम किया। लेकिन जिन शोधकर्ताओं ने प्राकृतिक विविधता से प्राप्त यौगिकों को निकाला और प्रयोग किया, वे ऐसी दवाएं विकसित नहीं कर सकते थे जो इसके बिना मेरे जीवन को बचा सके। मैं हमेशा से जानती थी कि प्राकृतिक विविधता हमें कैंसर जैसी स्थितियों से लड़ने के लिए दवाएं प्रदान करती है, लेकिन इस उपचार के प्राप्त होने के कारण मुझे इसके बारे में एक नए तरीके से सोचना पड़ा। जैसे कि मैंने अफ्रीका में देखा यह विविधता सिर्फ बड़े रोमांचक जानवरों की विविधता ही नहीं है जो कि महत्वपूर्ण है, बल्कि जिसने मुझे उपचार के दौरान अपनी यात्रा के लिए मानसिक रूप से दृढ़ता प्रदान की।

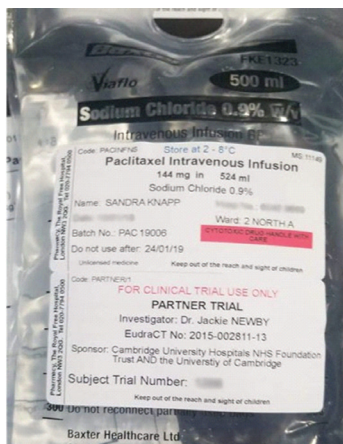
जैव विविधता के अनेक वे तत्व भी हैं जिन्हें अनदेखा किया जा सकता है। बैक्टीरिया व छोटे जीव भी प्रकृति के सबसे अच्छे रसायनज्ञ हैं। यद्यपि हम यौगिकों का आविष्कार कर सकते हैं, जो लाखों वर्षों के विकास की कसौटी पर खरे उतरे हैं, वे अक्सर सबसे प्रभावशाली होते हैं।



बाएं: सैंडी स्तन कैंसर के इलाज के दौरान चिकित्सालय में

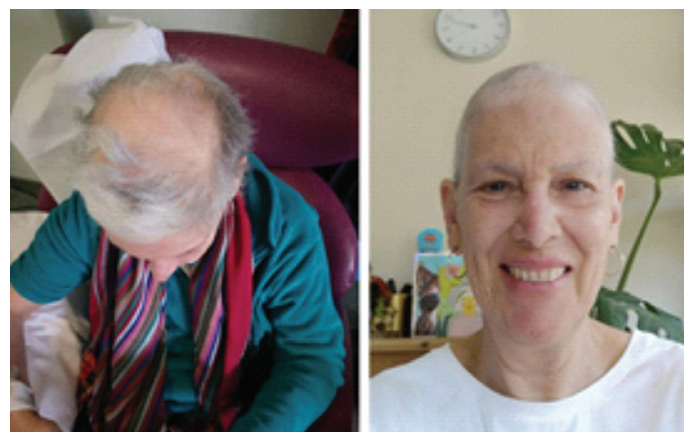


दाहिने: ड्रिप के साथ



मुझे खुशी है कि मैंने क्लिनिकल परीक्षण में भाग लिया जिसमें सामान्य लोगों के ऊपर एक और कीमोथेरेपी दवा शामिल हुयी क्योंकि इस तरह भविष्य में लोगों के लिए बेहतर उपचार उपलब्ध हो सकते हैं। डॉ. सैंडी ने अपने इलाज के दौरान प्रकृति में बाहर निकलने का कोई भी मौका नहीं छोड़ा इसलिए वह काफी अच्छा महसूस कर रही थी। डॉ. सैंडी कहती हैं, दवाओं ने अपना काम अच्छे से किया और मेरी बुरी तरह से व्यवहार करने वाली कोशिकाओं को नष्ट कर दिया और मैंने खुद को बीमार मानने से इनकार कर दिया। कैंसर एक जानलेवा बीमारी है, लेकिन इससे निपटने के लिए मेरा उद्देश्य जैविक उपायों के बारे में सोचना था। ट्यूमर, कोशिकाओं के समूह - जो सही ढंग से व्यवहार नहीं कर रहे थे और नियंत्रण में नहीं थे। मैं अपनी खुद की कोशिकाओं से निपट रही थी जो नियंत्रण से बाहर थीं।

डॉ. सैंडी ने केमोथेरेपी चिकित्सा के दौरान बालों का झड़ना तथा बीमारी का अनुभव किया जो आम साइड इफेक्ट्स होते हैं।



कौन जानता है कि अगली दवा की खोज कब, कैसे और कहाँ होगी? यह लगभग निश्चित रूप से कुछ ऐसा होता है जिस पर हम कभी विचार नहीं करते। नयी खोज की दवाओं को चिकित्सीय प्रयोग में लाने में लंबा समय लगता है।

क्या हम यह नहीं मानते हैं कि भविष्य की पीढ़ियों के लिए, कोई आविष्कार चाहे कितना भी छोटा क्यों न हो, अच्छी जैव विविधता से हमें स्वास्थ्य और कल्याण के सभी क्षेत्रों में लाभ मिल सकता है।

डॉ. सैंडी कहती हैं, मेरी जीवन यात्रा एक ऐसी जगह से शुरू हुई, जहां मैंने मानवीय समस्याओं के समाधान के लिए पृथ्वी की जीवनीय शक्ति की उपयोगिता की पहले ही सराहना की थी। लेकिन जब यह समस्या व्यक्तिगत हो गयी, तो पौधों और

जीवाणुओं से प्राप्त दवाओं ने वास्तव में मेरी जान बचाई। जैव विविधता का मूल्य स्वयं भी व्यक्तिगत हो जाता है। मैं अब इसके अस्तित्व के लिए पहले से भी कठिन संघर्ष करने के लिए दृढ़ संकल्पित हूँ।

मेरे लिए, डेविड एटनबरो का वह कथन सही था, “No one will protect what they don’t care about, and no one will care about what they have never experienced”. “कोई उसकी रक्षा नहीं करेगा जिसकी उसे परवाह नहीं है, और कोई उसकी परवाह नहीं करेगा जिसे उसने कभी अनुभव नहीं किया है।”

मैं कैंसर के अपने इस सफर को किसी के साथ भी नहीं दोहराना चाहूँगी, लेकिन अगर हममें से हर कोई प्रकृति को थोड़ा बेहतर तरीके से जानने की कोशिश करे, तो हम सब मिलकर जीवन की उस विविधता का समर्थन कर सकते हैं जिसने अंततः मेरी जान बचाई। सैंडी ने अपने इलाज के दौरान प्रकृति के साथ रहने के हर अवसर को इस्तेमाल किया और वह अब स्वस्थ जीवन व्यतीत कर रही है।



तालीशपत्र व आयुर्वेद

तालीशपत्र का प्रयोग आयुर्वेद चिकित्सा में हजारों वर्षों से होता आया है। आधुनिक काल में इसमें मौजूद टैक्सोल (Taxol) का प्रयोग कैंसर के इलाज के लिए किया जाता है। दवाईयाँ बनाने के लिए इस रसायन की इतनी मांग है कि हिमालयाई तालीशपत्र के अस्तित्व को ही खतरा हो गया है। वैसे तो तालिशपत्र का वर्णन कई प्राचीन आयुर्वेदीय-संहिताओं एवं निघण्टुओं में प्राप्त होता है। चरक-संहिता में क्षय-चिकित्सा के लिए तालिशपत्र चूर्ण तथा वटी के प्रयोग का उल्लेख मिलता है। सुश्रुत-संहिता में भी तालीशपत्र का वर्णन है। वस्तुतः तालीशपत्र के विषय में बहुत मतभेद है। तालिशपत्र के नाम से निम्न तीन पौधों का विवरण मिलता है:

1. *Abies spectabilis* (D. Don) Mirb.: इसका प्रयोग पश्चिमी बंगाल में किया जाता है। बाजार में भी सामान्यतः यही तालीशपत्र नाम से मिलता है।
2. *Taxus wallichiana* Zucc.: इसका प्रयोग उत्तर प्रदेश, उत्तराखण्ड, राजस्थान व गुजरात में किया जाता है।
3. *Rhododendron anthopogon* D- Don: पंजाब में इसके पते को तालीशपत्र के नाम से प्रयोग किया जाता है।

तालिशादि चूर्ण: यह शास्त्रीय पाठ शारंगधरसंहिता में सूचीबद्ध एक प्रसिद्ध पॉलीहर्बल आयुर्वेदिक औषधि है। मौसम के बदलाव से सर्दी, खाँसी, बुखार होना शुरू हो जाता है, तो तालीशपत्र का चूर्ण का सेवन खाँसी से राहत दिलाये साथ ही इसका उपयोग क्षुधावर्धक (भूख बढ़ाने वाला) के रूप में किया जा सकता है और यह पाचन में सहायक हो सकता है।

Sanskrit Verses

तालीशपत्र मरिचं नागरं पिप्पली शुभा ।
यथोत्तरं भागवृद्ध्या त्वगेले चार्धभागिके ॥१४५॥
पिप्पल्यष्टगुणा चात्र प्रदेया सितशर्करा ।
कासश्वासारुचिहरं तच्चूर्णं दीपनं परम् ॥१४६॥
हृत्पाण्डुग्रहणीदोषशोषप्लीहज्वरापहम् ।
वम्यतीसारशूलघ्नं मूढवातानुलोमनम् ॥१४७॥
कल्पयेद्गुटिकां चैतच्चूर्णं पक्त्वा सितोपलाम् ।
गुटिका ह्यग्निसंयोगाच्चूर्णाल्लघुतराः स्मृताः ॥१४८॥
इति तालीशायं चूर्णं गुटिकाश्च ।

References

Charaka Chikitsa Sthana 8/145-148
Sharangdhara Samhita Madhyama Khanda 6/130-133

S.No.	Ingredients	Quantity
1.	<i>Abies spectabilis</i> (D.Don) Mirb.	1 g
2.	<i>Piper longum</i> L.	4 g
3.	<i>Piper nigrum</i> L.	2 g
4.	<i>Zingiber officinale</i> Rosc.	3 g
5.	<i>Cinnamomum verum</i> J. Presl.	½ g
6.	<i>Elettaria cardamomum</i> (L.) Maton	½ g
7.	<i>Bambusa bambos</i> (L.) Voss	5 g
8.	Sugar	32 g

मात्रा:- 3-5 ग्राम तालीशपत्र चूर्ण में शहद या अदरक का रस मिलाकर चटाने से खांसी साँस फूलना, भूख न लगना आदि रोगों में लाभ होता है तथा अपच की समस्या आदि में लाभ मिलता है तथा भूख बढ़ती है।

लगभग 300-200 ईसा पूर्व में आचार्य चरक ने कहा **नानौषधिभूतं जगत किञ्चित्**। अर्थात् इस जगत कुछ भी ऐसा नहीं जो औषधीय गुण से युक्त न हो केवल उपयोग व मात्रा जानकर ही उनका प्रयोग किया जा सकता है। फिर लगभग 500 साल पहले, स्विस् चिकित्सक और रसायनशास्त्री पारसेलियस Paracelsus (1493-1541) ने विष विज्ञान के मूल सिद्धांत को व्यक्त किया: “All substances are poisonous, there is none that is not a poison- The right dose differentiates a poison and a remedy”. “सभी चीजें विष हैं और कुछ भी विष के अलावा नहीं है, उचित मात्रा से ही कोई वस्तु औषधि व विष में विभेद करती है। अतः अक्सर संक्षेप में कहा जाता **अति सर्वत्र वर्जयेत्** अर्थात् अति को हर जगह छोड़ देना चाहिए या यूँ कहें यथासंभव अति से बचना चाहिए। दूसरे शब्दों में, कोई भी रसायन यहाँ तक कि पानी और ऑक्सीजन भी विषैला हो सकता है यदि शरीर में बहुत अधिक अंतर्ग्रहण या अवशोषित हो जाता है। किसी विशिष्ट पदार्थ की विषाक्तता विभिन्न प्रकार के कारकों पर निर्भर करती है, जिसमें

यह भी शामिल है कि कोई व्यक्ति कितने समय से पदार्थ के संपर्क में है, वे कैसे लक्षण उजागर करते हैं, और कितने समय तक रहते हैं।

यिव ट्री (टैक्सस बकाटा) और एक संबंधित प्रजाति जो बागवानों के लिए आम है, जापानी **यिव टैक्सस कस्पिडाटा** को दुनिया के सबसे जहरीले काष्ठीय पौधों में से एक माना जाता है, पेड़ के सभी घटकों के साथ, मांसल लाल भाग को छोड़कर बेरी में टैक्सिन की घातक मात्रा होती है, यह **यिव** में पाया जाने वाला एक विषैला तत्व है। टैक्सस की विषाक्तता इसके अल्कलॉइड टैक्सिन ए और बी से उत्पन्न होती है जो पौधे के सभी भागों में मौजूद होते हैं। टैक्सिन सोडियम और कैल्शियम चैनलों को अवरुद्ध करते हैं, ज्यादातर कार्डियोमायोसाइट्स होती हैं।

जबकि इसके विपरीत कैंसर की दवा पैक्लिटैक्सेल माइक्रोट्यूबुल्स को बाधित करता है। इसे एंटीमाइक्रोट्यूब्यूल एजेंट कहा जाता है। यह कैंसर कोशिकाओं के विकास और प्रसार को रोककर काम करता है। उच्च सांद्रता पर, PTX G2/M चरण में माइटोटिक विभाजन को रोकता है जबकि कम सांद्रता पर, एपोप्टोसिस को G0 और G1/S चरण में या तो Raf & 1 kinase सक्रियण या p53/p21 के माध्यम से मात्रा व सांद्रता के आधार पर प्रेरित किया जाता है।

‘Talishpatra’

	
<i>Taxus wallichiana</i> Zucc.	<i>Abies spectabilis</i> (D.Don) Mirb.
Family: Taxaceae	Family: Pinaceae
Common name: ‘Himalayan Yew’	Common name: ‘Indian Silver Fir’
Part used: Bark and needles of the tree	Part used: Leaves
Used for: Cancer treatment	Used for: Ayurvedic preparation cough and cold, asthma and tuberculosis
Chemical constituents: Taxol (generic name Paclitaxel)	Chemical constituents: Mainly monoterpenes (from essential oil), biflavonoid glycosides, phytosterols, and diterpene glycosides

Chronology -from *Taxus* to Taxol

In 1955	The NCI in the United States set up the Cancer Chemotherapy National Service Center (CCNSC) to act as a public screening centre for anticancer activity in compounds submitted by external institutions and companies.
In 1962	Samples of the Pacific yew's bark collected by Arthur Barclay (USDA).
2 years later	Doctors Monroe Wall and Mansukh Wani, together, discovered that extracts from this bark showed significant cytotoxic activity.
In 1965	More samples of bark were collected and sent to Wall's group for identification and subsequent purification of the active component.
In 1971	published the chemical structure of paclitaxel (or "taxol").
In 1977	Antitumor activity of paclitaxel was confirmed in the mouse melanoma B16 model. After which, it was selected as a candidate drug for clinical development.
In 1979	Dr. Susan Band Horwitz discovered how paclitaxel works. Dr. Horwitz found that the compound is an antimetabolic agent that blocks cancer cell growth by stopping cell division, resulting in cell death.
In 1987	Ross C. Donehower, M.D., and colleagues at the Johns Hopkins Oncology Center described paclitaxel as "a unique plant-derived substance that stops tumor growth.
In 1992	Thirty years after initially sampling <i>Taxus wallichiana</i> , and more than twenty years after researchers Wall and Wani reported the isolation and structure of paclitaxel, FDA finally approved its use against refractory ovarian cancer. In the following years, it has also been approved for the treatment of advanced breast cancer, AIDS-related Kaposi's sarcoma, and other malignancies.
In 1988,	Poitier and collaborators had published a semisynthetic route from needles of the European yew to paclitaxel
In 1992	extensive efforts were underway to accomplish the total synthesis of paclitaxel,
In 1993	Paclitaxel was discovered as a natural product in a newly described endophytic fungus living in the yew tree
In 2013	Bristol-Myers Squibb (BMS) was using the semisynthetic method utilizing needles from the European yew to produce paclitaxel.

सारतः **तालीशपत्र** इस बात का प्रत्यक्ष उदाहरण है कि विषाक्त पादप भी जीवनदायी हो सकता है, बस मात्रा और किस रोग में कितना देना है, इस बात का ध्यान रखना है। इसे एक योग्य चिकित्सक द्वारा इन्जेक्शन (पक्लिटेक्स 260 mg इन्जेक्शन) के रूप में भी दिया जाता है। आपका चिकित्सक निर्णय लेगा कि आवश्यक खुराक क्या है और आपको कितनी बार इसे लेने की जरूरत है। यह इस बात पर निर्भर करेगा कि आपका इलाज किस स्थिति के लिए चल रहा है और यह समय-समय पर बदल सकता है। आपको इसे ठीक वैसे लेना चाहिए जैसा आपके डॉक्टर ने बताया हो। इसे गलत तरीके से या अधिक मात्रा में लेने से बहुत गंभीर परिणाम हो सकते हैं।

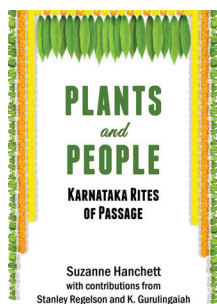
आभार (Acknowledgement): हम डॉ रानी ओम प्रकाश, वरिष्ठ

संग्राहक, प्राकृतिक इतिहास संग्रहालय, लंदन का आभार व्यक्त करते हैं, जिन्होंने यह प्रेरणा दायक लेख उपलब्ध कराया व इसे लोकप्रिय जनभाषा (हिंदी) में भावानुवाद कर पुनर्प्रस्तुत करने का सुझाव दिया और डॉ सैंडी नैप से सहमति, संस्तुति पत्र प्रदान करवाने में मदद की।

अस्वीकरण (Disclaimer): प्रस्तुत लेख जिसका उद्देश्य चिकित्सा करना नहीं बल्कि जनसाधारण में वैज्ञानिक ज्ञान व चेतना का प्रसार करना है, साथ ही विषय को रोचक बनाए रखने हेतु कुछ जानकारीयाँ इंटरनेट व अन्य पुस्तकों से उद्धृत आहरित हैं। कृपया चिकित्सा हेतु उचित चिकित्सक से परामर्श लें।

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BOOK REVIEW

Plants and People: Karnataka Rites of Passage, by Suzanne Hanchett, with contributions from Stanley Regelson and K. Gurulingaiah. 2023. pp. 1-219. 23×16 cm. Pasadena, California: Development Resources Press. Paperback ISBN: 979-8-9868769-2-4; e-book ISBN: 979-8-9868769-3-1

Plants are important part of human life. The association between plants and people is not only limited for fulfillment of basic needs of man. Plants are directly and indirectly involved in various rituals and ceremonies starting from human birth till death. Study of such association is another important facet of Ethnobotany and termed as culture-based man-plant relationships. However, less emphasis has been given to study culture-based relationships in ethnobotanical studies and in this regard; the present book is an excellent documentation of Karnataka rites involving people and plants.

The author, a social anthropologist, and her two associates, did in-depth interviews on two Brahmanas (Iyengar & Smartha); eight non-Brahman communities (Barber, Farmer, Fisherman, Oil Presser, Shepherd, Smith, Washerman and Weaver) and scheduled caste communities ('Adikarnataka', 'Holey' and 'Daas') residing in two villages of Hassan district in Karnataka. Basically, this book represents the results of a detailed ethnographic study revealing that trees, plants, and plant products are intertwined with the family life of multiple Hindu communities in Karnataka rural communities. It presents the careful observation of rites of passage – pregnancy, birth, maturation, marriage, death, and widowhood rituals – and other significant family ceremonies, such as ancestor worship and ceremonies to appease dangerous spirits. Every ritual is described (with variations among communities) related to all plants or plant materials considered necessary.

The book begins with Introduction to Ethnobotany in India which presents some ancient and widespread roles assigned to plants such as the sacred fig, some flowers, vines, and so on, in mythology, folk sayings, and religious life. The works of authors such as Dr. S.K. Jain and Dr. Shakti M. Gupta are discussed in relation to the long-standing spiritual connection between plants and human life in Indian culture.

The text is then described into three parts. Part I describes the customary uses of plant materials in various family rituals such as birth, cradle, naming ritual; maturation rituals for girls, initiation rituals for boys, marriage rituals, pregnancy rituals and rituals associated with death and widowhood. Part II summarizes the entire work by highlighting the most commonly used plants in family rituals as well as symbolic uses of some other plants and plant parts. Part III includes discussion and conclusions. After references and bibliography section, six annexure and subject index are given. The concluding sections summarize and discuss the religious or other symbolic meanings of commonly used plants or plant products, with some speculation on the possible reasons why some plants are given specific symbolic roles. Annexure 4 is very important in terms of Folk taxonomy that how people categorize plant materials and plant parts in local language. A glossary summarizes all Kannada names, botanical names, along with the plant uses in Annexure 6. There are 10 tables and 65 photographs (59 in color).

Authorities of some botanical names are missing besides some references in the list. Except these and some typographical errors, the book demonstrates the details of all important rituals performed in life time and after death of man. The field research for this book was done some time ago, in 1966-67 and 1976-77. Some practices would have changed over the years. But the book will endure as a careful study of plants' meanings and value to people in a specific time and place. It is a valuable contribution to the Ethnobotanical literature. It will be a motivating source for all those who wish to pursue ethnobotanical studies to understand culture-based man-plant relationships and in this way help in preservation of culture for future generations.

Dr. Vartika Jain
Udaipur



NEWS OF THE SOCIETY (2024)

1. Meeting of Executive Council and Editorial Board

The meeting of the Executive Council (EC) and Editorial Board (EB) of SEB was held on 03 October, 2024. Confirmation of the minutes of the last meeting was done besides briefing the members about updates on e-publication status of the journal **Ethnobotany**, website updates, local chapters update and the current status of SEB accounts.

Extension of the term of the present EC/EB was done alongwith the initiation of the process for the elections for new Executive Council & Editorial Board of SEB. Discussions were held about the nominations for the preparation of the list of candidates proposed by the outgoing EC/EB including the invitation of nominations from the SEB life members.

Dr. A. A. Mao, President, SEB provided valuable suggestions from time to time for the smooth functioning of the society.

2. SEB Local Chapters and updates regarding the status of their activities

• Goa Chapter

Department of Botany, Government College of Arts, Science and Commerce, Quepem, Goa, in association with the Research & Development Cell and the Society of Ethnobotanists (SEB), Goa Chapter, organized guest lectures on 14 August, 2024. Participants included: the undergraduate students, faculty members, and research scholars from Goa University. Objective of the lecture series was to enhance understanding about the orchids and medicinal plants, with special emphasis on their diversity, cultivation, conservation, and sustainable utilization.

First lecture was delivered by **Prof. A. Gangaprasad** from



Pictorial glimpses of the guest lectures

Botany Department, Kerala University, Thiruvananthapuram focusing on the diversity of orchids in Western Ghats. He discussed about their ecological importance and highlighted about various conservation strategies, including *in-situ* and *ex-situ* methods, for protecting orchids in natural habitats. Second lecture was delivered by **Dr. K. Radhakrishnan, Former Scientist, TBGRI, Thiruvananthapuram**. He talked about the conservation, cultivation, and sustainable utilization of medicinal plants. He emphasized their significance in pharmacology, the threat of species extinction, and the need to develop the conservation practices such as habitat protection and joint forest management.

Manjoosha Srivastava



Report on National Workshop on Ethnobotany- Exploring the Cultural Connections to Plant Life (28–30 November 2024)

The Society of Ethnobotanists, Jammu, Kashmir & Ladakh Chapter, organized a three-day **National Workshop on Ethnobotany - Exploring the Cultural Connections to Plant Life** in the Department of Botany, University of Jammu. The event aimed to strengthen the understanding of traditional ecological knowledge, plant-culture relationships, and sustainable use of biological resources. It brought together resource persons, researchers, teachers, and students for lectures, discussions, and hands-on training. Approx. 27 participants from various institutes, including Govt. Degree College, Bani, Government College for Women (GCW) Gandhi Nagar, Cluster University of Jammu, Govt PG College Rajouri, Central University of Himachal Pradesh, and RARI (CCRAS), directly benefited from the experts. The event was sponsored by SERB–DST, New Delhi.

- Day-1 (November 28, 2024) The inaugural session was

held on November 28, graced by Dr. Anil K. Goel (as Chief Guest) and Prof. Namrata Sharma (as Guest of Honour). Prof. Susheel Verma delivered the welcome address, and Dr. Harish Chander Dutt outlined the workshop's objectives. Speakers highlighted the relevance of ethnobotanical knowledge for biodiversity conservation, sustainability, and community well-being. The second session included lectures by experts - Dr. A.K. Goel on the scope of ethnobotany in bio-prospection, Dr. V.V. Wagh on ethnobotanical research methodology, and Dr. Arvind Saklani on the role of ethnobotanists in supporting community livelihoods and the bio-economy. A demonstration on field data collection and specimen handling prepared participants for the field visit.

- Day-2 (November 29, 2024), participants undertook a field tour to Akhnoor under the guidance of Shri





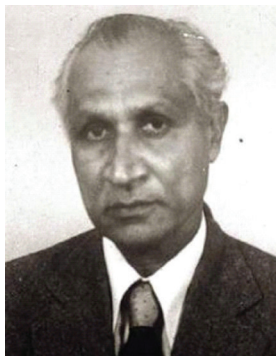
Om Prakash Sharma Vidyarthi (Retd. IFS). Activities included plant identification, specimen collection, documentation of traditional uses, and hands-on training in herbarium specimen processing, data recording, and ethnobotanical analysis.

- Day-3 (November 30, 2024) featured lectures by Dr. Shreeker Pant on the contribution of ethnobotany to sustainability and by Dr. Vartika Jain on cultural man-plant relationships. A data discussion session allowed participants to synthesize field observations and understand practical applications of ethnobotanical methods. The valedictory ceremony, with Sh. O.P. Sharma Vidyarthi as Chief Guest, formally concluded the workshop.

Participants appreciated the blend of academic and practical components, high-quality lectures, and well-organized field activities. The workshop enhanced knowledge on the cultural importance of plants, strengthened academic linkages, and promoted awareness of the significance of traditional knowledge in biodiversity conservation. The organizers express gratitude to SERB-DST for financial support, the University administration for encouragement, resource persons for sharing their expertise, and participants for their enthusiastic involvement. The workshop successfully met its objectives and set the stage for future initiatives in ethnobotanical research and knowledge exchange.

Harish Chander Dutt
Organizing Secretary

OBITUARY

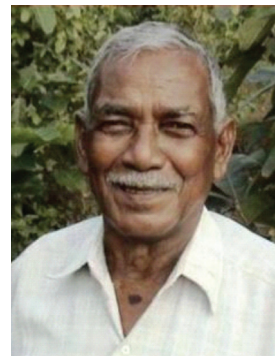


Dr. Akhtar Hussain (1928-2024)

Dr. Akhtar Husain, a dynamic director of CSIR - Central Institute of Medicinal & Aromatic Plants, Lucknow passed away on 19 Nov., 2024. He was the founder Life Member and Vice- President of the Society of Ethnobotanists founded under the secretary-ship of Dr. N.C. Shah, the then Scientist at CSIR-CIMAP during 1980. Dr Husain was born in Handia, Basti, (UP) on 1st July, 1928. Educated at Anglo Sanskrit High School, Basti, 1944-48; Govt. Agricultural College, Kanpur, 1948-54; North Carolina State University, 1954-57; B.Sc. (Ag) 1952, M.Sc. (Ag) 1954, Ph.D. 1957.

He was: Assistant Plant Pathologist, Connecticut Agriculture Experiment Station, USA, 1957; Plant Pathologist, 1958-62, and Head, 1962-63, Regional Research Centre, ICAR, Kanpur; Scientist, Regional Research Laboratory, Jammu (Now IIIM), J&K, 1963-74; Scientist, 1974-75, Deputy Director, 1975-77, and Director, 1977-88, CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow, UP; Vice Chancellor, Jamia Hamdard, 1988-90; UNDP Consultant in Egypt, Syria, Iraq, Sudan, and Kenya; WHO Consultant in Bangladesh, Sri Lanka, and UNESCO Consultant in Afghanistan. He was awarded. Vasvik Award, 1983, and a fellow of the Indian National Science Academy; National Academy of Sciences, India.

N.C. Shah
Head of Botany & Pharmacognosy Department
CSIR- CIMAP, Lucknow



Sri Peter Paul Hembrom (1939-2024)

Sri Peter Paul Hembrom, belonging to a Munda tribe, was born on **15th March, 1939** in Bihar. He did extensive work to promote and preserve ethnobotany. Sri P.P. Hembrom was DFO and was posted in various regions of Santal Pargana then in Bihar province but later on he resigned from the forest services. Sri Hembrom took assignment with Paharia Samaj Seva Samiti at Dumka (Bihar) in 1980. He started working on Paharia group of tribals including other indigenous communities of Bihar. He and Sri P.A. Chako a priest both started a training centre in Litipara block at village Satia (Pakur district) and started first Hodopathy Centre. He trained neraly 3 Lakhs young tribals and other local herbal medicinal healers and practitioners to promote ethno-medicine in Bihar.

Sri Hembrom was a lifemember of the Society of Ethnobotanists and published many papers in the SEB journal ***Ethnobotany***. Considering his immense contributions in ethnobotany, he was awarded the **JW Harshbergher Medal** during 2004. He wrote many popular booklets like: Adivasi Aushad in 7 volumes funded by the Ministry of Science & Technology, New Delhi. He became President of Torang Trust in 2012 and continued till 2020. He also published many articles and booklets on **Mahua**. He breathed his last on **24 Nov., 2024** at the age of 86 years. He was a great inspiration for the young tribal medicine men.

Basavi Kiro & Anil K. Goel



INSTRUCTIONS FOR CONTRIBUTORS

The *Ethnobotany* is a half-yearly international journal which publishes research and review papers on all aspects of ethnobotany and related fields. All authors should be members of the Society. Annual members will be entitled to submit one paper in joint authorship of a life member only with year of their membership.

Manuscript in English, not exceeding 3000 words (including tables and references), typed in double space in 'Times New Roman' font (size 12 pt.) on one side of paper (21×28 cm) leaving 2.5 cms margin on all sides, should be submitted through mail (Larger manuscripts may be considered on payment). One page of tables or figures will be treated as 500 words. For extra matter Rs. 400/- will be payable for every 500 words or part thereof.

Manuscripts for publication should be sent to Dr. Anil Kumar Goel; Email: editor.ethnobotanyindia@gmail.com. Authors should also provide Hindi translation of the title of paper, author's address and abstract in brief.

In the title of the article only those words will have first letter as Capital which will ordinarily start with Capital letter in the text also, like names of ethnic groups, plant genera, names of authors, and other proper nouns, *for example: Traditional herbal remedies among Tharus of Babraich district.*

Style: The title should be brief followed by name(s) of author(s), address and e-mail, an abstract (up to 150 words), and 4-6 keywords, Ethnobotanical, phytochemical, ethno-pharmacological and other data on plants must give proper reference of the voucher specimen, i.e. name, collector, number, locality, accession number and name of herbarium where specimens are deposited, Local names of plants and any words other than English (or the main language of the article) should be given in single inverted commas like 'Shivlingi', 'Sarpagandha', and 'Mukhia', 'Pujari'. In enumerations, genera and species should be given in the alphabetical order.

Nomenclature of plants: Authors must check very carefully the nomenclature and authors of plant names in their papers. Authors are advised to compare names with the latest published literature/references on Ethnobotany (i.e. *Dictionary*

of Indian Folkmedicine and Ethnobotany), taxonomic revisions, floras, and different plant data bases like: Tropicos, IPNI, Plant List and POWO, etc., to ensure updated nomenclature of the plants. Similarly, names of the author(s) of the plant names should be abbreviated as per the Brummitt and Powell (1992) or the guidelines provided by them.

Footnotes should be given by numbers running through the whole paper. Words desired to be printed in italics should be in **italicized font only**. For different units of measurements (distance, height/elevation, length/width, weight, etc.) only metric system should be used.

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Book:

Dhawan, B.N. (ed.) 1986. *Current Research on Medicinal Plants in India*. I.N.S.A., New Delhi.

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