The enchanting flora of Chamba: Unveiling sacred and magico-religious plants in Himachal Pradesh

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Research

Abstract

Background: The current research was carried out in the Chamba district of Himachal Pradesh to investigate and document ethno-magico-religious beliefs based on plant uses.

Methods: Data was collected through extensive field surveys using semi-structured questionnaires and open discussions with various ethnic groups. This study involved 45 informants, primarily older individuals with no formal education level. Magico-religious beliefs of plants were categorized into magic beliefs, sacred practices, social ceremonies, and taboos. The data was analysed with the help of quantitative indices such as informant consensus factor (ICF), relative frequency of citation (RFC), relative importance index (RI), cultural value (CV) and cultural importance index (CI).

Results: The 45 households, provided the information of 47 plant species belonged to 27 families were documented. Herb and tree worship were common, with 21 and 18 species associated with religious beliefs. The most utilized plant parts were the whole plant, fruits, and leaves. The social ceremonies use category had the highest consensus factor among informants for uniform information. *Cynodon dactylon* had the highest citation frequency, and *Hordeum vulgare* ranked highest in cultural importance.

Conclusions: Comparisons with previous studies showed the conservation of certain plant species across India based on religious beliefs. This conservation contributes to biodiversity and traditional knowledge conservation. Overall, the study emphasizes the cultural significance of plants and the need for conservation strategies integrating cultural values.

Keywords: Sacred, Sustainable, Deities, Relative importance, Cultural value

Background

Since ancient times, plants have held a significant and unique role in the religious and social lives of humans (Manilal 1989). In India, there is a longstanding tradition of plant worship, with many plants being considered sacred due to their close association with deities. Many plants/parts are directly related to deities or specially offered in a religious way to appease them**.** Historical literature reveals that Lord Vishnu is closely linked to the Peepal tree (*Ficus religiosa*), while Lord Shiva is connected to the Bael tree (*Aegle marmelos*) (Ramanayya 1985, Waheed *et al*. 2023). In India, there are approximately 468

plants of religious and magical significance, belonging to 133 different families (Sood *et al.* 2005). The main purpose of these magical and sacred beliefs surrounding plants is to ensure their conservation, systematic utilization, and sustainable use of their various parts (Ravishankar 1996). These tribal beliefs, imbued with a sense of sacredness, magic, and the supernatural, serve as a deterrent against unsustainable harvest practices of these plants. While many researchers have focused on the practical uses of plants for food, fiber, and medicine, little attention has been given to their magical and religious practices (Devi *et al*. 2020, Sharma *et al.* 2012, Thakur *et al.* 2021). The study area is district Chamba of Himachal Pradesh, which is geographically isolated, and its inhabitants possess distinct cultural beliefs rooted in religiosity and devotion to the local deity. Hence, this study represents a modest endeavor to document the sacred and magico-religious plants found in this region.

Materials and Methods

Study area

The study was conducted in the Chamba district of Himachal Pradesh, as shown in Figure 1. The district shares borders with Jammu & Kashmir in the north and northwest, Ladakh in the northeast, Lahaul-Spiti in the east, Kangra in the south and southeast, and Gurdaspur district of Punjab in the southwest. It is located between 32°11'30'' and 33°13'6'' north latitude and 75°49' and 77°3'30'' east longitude. The total estimated area of the district is approximately 6,522 sq. km. The region is predominantly mountainous, with elevations ranging from 600 to 6,500 meters. Chamba is renowned for its picturesque natural beauty and is considered the land of Lord Shiva. The district is mainly inhabited by migratory shepherds (Gaddis) and semi-pastoral Gujjars, while the Ravi River flows through the area. The average annual rainfall is around 670 mm, and temperatures vary from -10 to 35 °C. The district boasts rich floral diversity, with vegetation ranging from subtropical to alpine. Notable plant species include Berberis, Chir pine, Deodar, Kail, Birch, and Oaks forests.

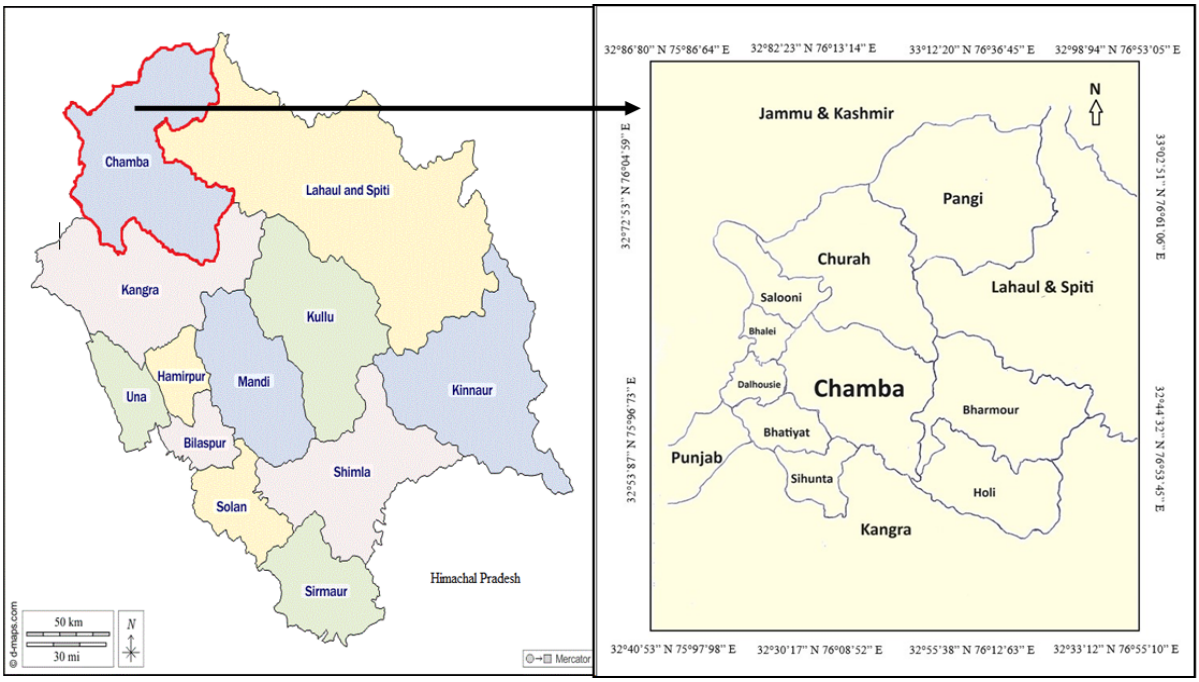

Figure 1. Map of the study area

Data collection

For data collection, an extensive field survey was conducted in the study area from October 2021 to December 2022. After getting verbal prior informed consent (Rahman *et al.* 2022) and following the code of ethics as prescribed by the International Society of Ethnobiology (2008), a total of 45 informants (27 males and 18 females) were included in the study spanning various age groups from 30 to over 60 years old. The educational background of the informants was also recorded during the survey (Table 1). The current investigation sought to include key informants who actively practice and hold expertise in the magical and religious utilization of plants. Wizards and priests, recognized for their proficiency in these domains, were deliberately chosen as participants. The selection process was meticulously conducted through direct observation, employing purposive sampling to ensure that individuals with substantial insights and experiences were included in the study. This method was chosen to provide a thorough exploration of the diverse perspectives and practices associated with the mystical and spiritual applications of plants as articulated by these knowledgeable informants (Bah *et al*. 2006, Dolores & Tongco 2007, Hammiche & Maiza 2006, Jarvis *et al*. 2004, Martinez-Romero *et al*. 2004, Silva & Andrade 2006). Interviews and discussions

regarding the magico-religious uses of plants were conducted with the local people (wizards and priests), through a semi-structured questionnaire (Jain & Mudgal 1999) and focus group discussion with knowledgeable persons (Addis *et al.* 2005). Information about the vernacular names of plants, their habits, the parts used, and different magico-religious beliefs were recorded in a field notebook (Table 3). We considered valid only that information which has been confirmed to us by two or three informants. Photographs of plant specimens were taken during the flowering and fruiting seasons, and fresh specimens were sustainably collected and dried for herbarium sheet preparation and affixed to herbarium sheets (Jain & Rao 1977). The identification of plants was aided by the various regional flora, Flora of India (Hajra *et al*. 1996), Flora of Himachal Pradesh (Chowdhery & Wadhva 1984), specifically the "Flora of Chamba district Himachal Pradesh" (Singh & Sharma, 2006). The names of species and families were verified using the online databases "The World Flora Online" (The World Flora Online 2023) and "Plants of the World Online" (Plants of the World Online 2023). The map has been drawn with help of d-maps.com (Source: https://d-maps.com/carte.php?num_car=31555&lang=en).

Quantitative analysis

The information collected from the field study was categorized into four use categories (UC) which are Magic beliefs (MAG), Sacred (SAC), Social ceremonies (SC), and Taboos (TAB) (Table 2). Furthermore, the culturally important plants were identified by using the ethnobotanical indices. The informant consensus factor (ICF), basic variables like frequency of citation (FC), use reports (UR), the number of uses (NU), and important indices like relative frequency of citation (RFC), relative importance index (RI), cultural importance index (CI) and cultural value index (CV) were calculated and compared.

Informant consensus factor (ICF) is determined by the formula suggested by Heinrich *et al.* (1998).

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

Where, Nur = the number of use reports cited for the particular use category, Nt = Number of taxa used in that particular use category. The high value of ICF indicates the homogeneity of information for various uses among the informants.

Table 1. Demographic characteristics of informants

Age group	**Gender**		**No. of persons**	**Percentage (%)**
	Male	Female		
30-40	3	1	4	8.89
40-50	5	3	8	17.78
50-60	8	6	14	31.11
>60	11	8	19	42.22
Total	27	18	45	100
Educational qualification of informants				
Education	**No. of informants**		**Percentage of informants**	
	Male	Female	Male (%)	Female (%)
Non-school going	8	6	29.63	33.33
Primary (1st – 5th)	6	4	22.22	22.22
Middle (6th – 8th)	6	3	22.22	16.67
Matric	4	3	14.81	16.67
Above matric (11th – 12th)	3	2	11.11	11.11

Other indices were calculated by using the formulae used by Tardio and Pardo-de-Santayana (2008).

1. Frequency of citation (FC)

2. Use reports (UR):

$$URs = \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} URui$$

Where, UR_s= Use report of species, UR_{ui}= Sum of the uses reported in each category.

3. Relative frequency of citation (RFC)

$$RFCs = \frac{FCs}{N} = \frac{\sum_{i=i1}^{iN} URi}{N}$$

Where, FC = Frequency of citation (excluding use categories), N = Total number of informants.

4. Relative importance index (RI)

$$RIs = \frac{RFCs(max) + RNUs(max)}{2}$$

Where, $RFCs_{(max)}$ = Relative frequency of citation over the maximum, it is obtained by dividing the frequency of citation by the maximum frequency of citation in all species.
$RFC_{s(max)} = FC_s/max(FC)$
$RNU_{s(max)}$ = Relative number of use categories over the maximum, obtained by dividing the number of uses by the maximum number of uses in all species.
$RNU_{s(max)} = NU_s/max(NU)$

5. Cultural value index (CV)

$$CVs = {}^{NUs}/_{NC} \times {}^{FCs}/_{N} \times \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} {}^{URui}/_{N}$$

Where, NUs/NC = Relationship between the number of uses for the species and the total number of use categories.
FCs/N = Relative frequency of citation.
$\sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} {}^{URui}/_{N}$ = Sum of use reports of species divided by the total number of informants. Cultural value is the product of NU_s/NC, RFC and cultural index.

6. Cultural importance index (CI)

$$CIs = \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} {}^{URui}/_{N}$$

Where, UR = Sum of use reports of species in each category and N = Total informant

Table 2. Use categories with the number of use reports (Nur) and number of species

Use Categories (Codes)	Nur	Percentage	No. of Species	Percentage
Magic beliefs (MAG)	177	37.11%	23	41.07%
Sacred (SAC)	148	31.03%	16	28.57%
Social ceremonies (SC)	119	24.95%	12	21.43%
Taboos (TAB)	33	6.92%	5	8.93%
	477	100	56	100

Table 3. Plants Used by People of District Chamba, Himachal Pradesh for Sacred & Magico-religious Purposes

Botanical Name; Family	IUCN Status	Vernacular Name	Habit	Part/s Used	Use Category codes	Religious Beliefs & Uses
Achyranthes bidentata Blume; Amaranthaceae	-	Puthkanda, Umbalkanda	H	WP	MAG	Dried plant is used in 'Dhooni & Hawan' to ward off evil spirits & also used by local 'Tantriks' for witchcraft.
Acorus calamus L.; Acoraceae	LC	Baryaa	H	Rh	MAG	A piece of rhizome is tied on the neck of the babies as magico-religious belief to protect them from cold diseases.
Aegle marmelos (L.) Corrêa; Rutaceae	NT	Bel, Bil	T	Fr, Lf	SAC	Fruits & leaves are used in worshiping of Lord Shiva.
Artemisia nilagirica (C.B.Clarke) Pamp.; Asteraceae	-	Chharmar	S	Rt	MAG	Dried roots are used in 'Dhooni' to ward off evil spirits.
Betula utilis D.Don; Betulaceae	LC	Bhujj, Bhujjpatra	T	Bk	MAG	The bark is used in 'Hawan samagri', Dhooni & also tied in lockets.
Bombax ceiba L.; Malvaceae	LC	Simbal	T	WP	SAC, TAB	The plant is considered sacred as a symbol of the local forest protector deity (Banveer), so the movement of people around the plant is restricted. It is also worshiped by local 'Tantriks'.
Brassica rapa L.; Brassicaceae	-	Saryan, Sarso	H	Sd	MAG	Seeds of *B. campestris* & *Hordeum vulgare* (Jau) packed in a piece of cloth and tied to the door frame during house construction.
Cannabis sativa L.; Cannabaceae	-	Bhang	H	Lf	SAC, SC	Leaves are used to worship Lord Shiva. Also used to make 'Ghota' during 'Mahashivratri'.
Capsicum annuum L.; Solanaceae	LC	Mirchi, Pipli	H	Fr	MAG	Fruits are tagged with 'Nimbu' and hung on house doors to keep away evil spirits.
Cedrus deodara (Roxb. ex D.Don) G.Don; Pinaceae	LC	Dyar, Kalein	T	WP	SAC	Plants is worshiped as a sacred plant.
Citrus × limon (L.) Osbeck; Rutaceae	-	Nibmu	S	Fr	MAG	Fruits are tagged with '*Capsicum annuum*' and hung on doors to keep away evil spirits.
Citrus medica L.; Rutaceae	LC	Amman	S	Lf	SC	Leaves are used in various social ceremonies.
Curcuma longa L.; Zingiberaceae	-	Haldi, Haldar	H	Rh	SC	Powder of dried rhizomes is used as an aesthetic during marriage ceremonies.
Cynodon dactylon (L.) Pers.; Poaceae	-	Drub	H	AP	SC	A bunch of aerial parts is used in various religious ceremonies for offerings.

Datura stramonium L.; Solanaceae	-	Dhatura	H	Fl, Fr	SAC	Flowers and fruits are offered to worship Lord Shiva.
Deeringia amaranthoides (Lam.) Merr.; Amaranthaceae	-	Bhirang	S	WP	SAC	The plant is considered sacred as a symbol of 'Banveer', and is also worshiped by some 'Tantriks'.
Dolomiaea macrocephala DC. ex Royle; Asteraceae	-	Dhoop, Guggal	H	Rt	MAG	Dried roots are used to make 'Dhoop', which is burned for good incense and also used in 'Hawan'.
Eulaliopsis binata (Retz.) C.E. Hubb.; Poaceae	-	Baggarh	H	AP	SC	A rope (Saand or Ghar Janeu) is made from aerial parts with the leaves of *Citrus medica* or *Mangifera indica* and red thread (Dori), Which is hung on house walls during religious & social rituals (House inaugurations, Marriages & Nuala).
Ficus carica L.; Moraceae	LC	Dhurhi, Fakuri	T	WP	SAC, TAB	The plant is considered sacred (Symbol of Banveer). Movement of pregnant women is restricted around the tree.
Ficus palmata Forssk.; Moraceae	-	Dhurha, Fakura	T	WP	SAC, TAB	The plant is considered sacred (Symbol of Banveer). Movement of pregnant women is restricted around the tree.
Ficus religiosa L.; Moraceae	LC	Peepal	T	WP	SAC	The plant is considered sacred and worshiped as a symbol of Lord Vishnu.
Hordeum vulgare L.; Poaceae	LC	Jau	H	Sd, YS	SAC, SC	Crushed seeds or flour are used to make 'Pinds' during 'Pindaan' for the peace of the forefather's soul. Seeds are also used in 'Hawan Samgri'. Young seedlings are worshiped during 'Navratris' and disposed of in running water.
Hymenolaena candollei DC.; Apiaceae	-	Baan	H	WP	MAG	The dried plant is kept together with *Saussurea gossipiphora* (Ghuggi) in houses to ward off evil spirits.
Jasminum officinale L.; Oleaceae	-	Swain	H	Lf	SC	Leaves are used for aesthetic purposes in marriages.
Juglans regia L.; Juglandaceae	LC	Khod	T	WP	SAC, TAB	The plant is considered sacred and the movement of pregnant women is restricted around the plant.
Juniperus indica Bertol.; Cupressaceae	LC	Bither	T	WP	MAG	Dried plant parts are used in 'Hawan' & also burned for incense.
Juniperus recurva Buch.-Ham. ex D.Don; Cupressaceae	LC	Bither, Devi Dyar	T	WP	MAG, SAC	Dried parts are burned for incense and also worshiped by ladies as a symbol of 'Devi'.

Mangifera indica L.; Anacardiaceae	-	Amb	T	Lf	SC	Leaves are used in social ceremonies.
Melia azedarach L.; Meliaceae	LC	Darek	T	Fr	MAG	Fruits are used in 'Karwa hawan' to ward off evil spirits.
Morina longifolia Wall. ex DC.; Caprifoliaceae	-	Tingla	H	Fl	MAG	Dried flowers are mixed with *Dolomiaea macrocephala* to make dhoop.
Ocimum tenuiflorum L.; Malvaceae	-	Tulsi	H	WP	SAC	The plant is worshiped as sacred. Leaves are offered in worshiping of Lord Vishnu.
Onosma hispida Wall. & G.Don; Boraginaceae	-	Kom	H	Rt	SC	The red dye obtained from roots is used in social ceremonies
Pinus roxburghii Sarg.; Pinaceae	LC	Cheel, Chil	T	Wd	MAG	Highly resinous wood (Jangni) is considered pure and used to ignite the 'Hawan'.
Prinsepia utilis Royle; Rosaceae	-	Kanrgora	S	St	MAG, SC	1-2 feet long twigs are hung on the main door to ward off evil spirits. (Mostly hung on 'Maha Shivratri' & removed on upcoming Holi festival).
Prunus cerasoides Buch.-Ham D.Don; Roasaceae	LC	Pajja	T	Bk	SC	The bark is used to bathe the bride during marriage ceremonies.
Prunus persica (L.) Batsch; Rosaceae	-	Aarhu	T	Wd	MAG	Sticks of wood are used for 'Hawan'.
Punica granatum L.; Lythraceae	LC	Darhu	S	St	SC	Long branches are used with gates (as Toran) during marriage ceremonies.
Pyrus pashia Buch.-Ham. ex D.Don; Rosaceae	LC	Kainth	T	WP	SAC, TAB	The plant is considered sacred and the movement of people (especially pregnant women) around the plant is restricted during the night.
Sapindus mukorossi Gaertn.; Sapindaceae	LC	Dodan	T	Fr	MAG	Crushed fruits are used for 'Karwa Hawan' to ward off evil spirits.
Saussurea gossipiphora D. Don; Asteraceae	-	Ghuggi	H	WP	MAG	Dried plant is burned for incense & to purify the air.
Selinum vaginatum (Edgew) C.B. Clarke; Apiaceae	-	Bhootkeshi	H	WP	MAG	Dried plant is burned for incense and also used as 'Dhooni' to keep away the evils.
Taxus contorta Griff.; Taxaceae	EN	Barmi	T	Lf	MAG	Dried leaves are burnt as incense.
Tagetes erecta L.; Asteraceae	-	Gatt, Genda	H	Fl	SAC	Flowers are offered to worship the local deities.
Valeriana jatamansi Jones ex Roxb.; Caprifoliaceae	-	Nahni, Smak	H	Rt	MAG	Dried roots are mixed with 'Guggal' to make dhoop and also burned as incense.
Verbascum thapsus L.; Scrophulariaceae	-	Ban tambaku, Hanumanipoonchh	H	WP	MAG	Dried plant is used in 'Dhooni' to ward off evil spirits.

Vitex negundo L.; Verbenaceae	LC	Banaa	S	Tw	MAG	Fresh twigs are attached to the umbrella of new born babies to protect them from evil spirits.
Zanthoxylum armatum DC.; Rutaceae	LC	Timbar	S	St	SAC	The plant is considered sacred and its branches are kept in temples.

Abbreviations: H- Herb, S- Shrub, T-Tree, AP- Aerial parts, Bk- Bark, Fl- Flowers, Fr- Fruits, Lf- Leaves, Rh- Rhizome, Rt- Roots, Sd- Seeds, St- Stem, Tw-Twigs, WP- Whole plant, Wd- Wood & YS- Young seedlings, MAG- Magic beliefs, SAC- Sacred, SC- Social ceremonies & TAB- Taboos.

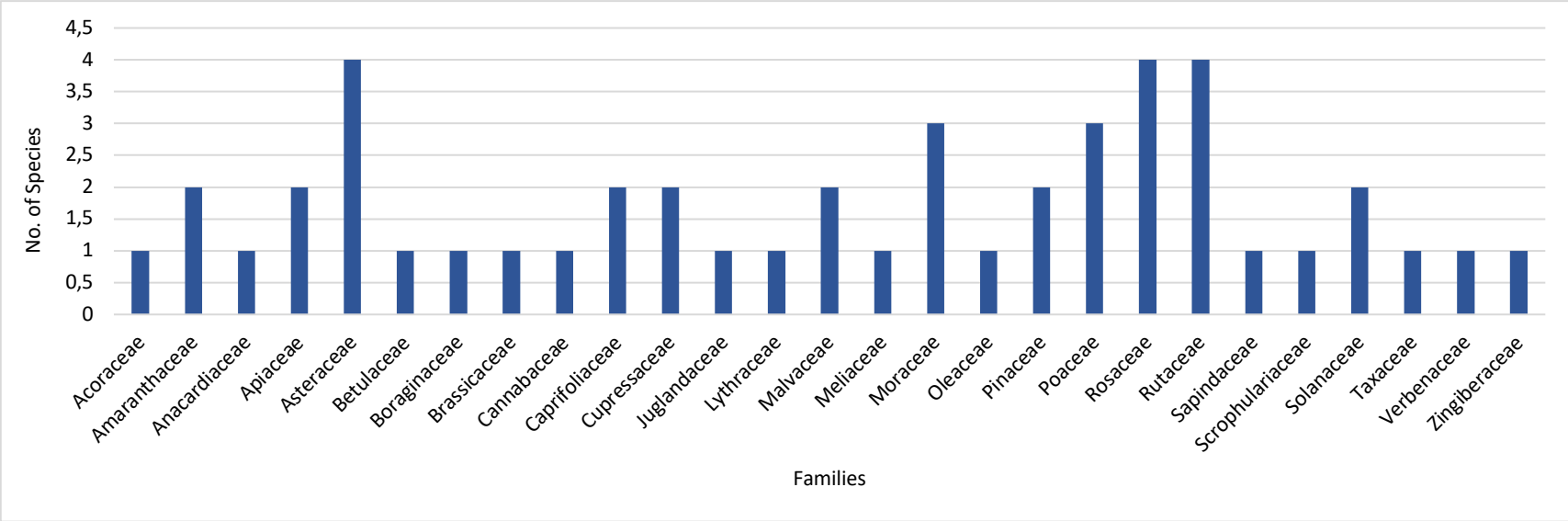

Figure 2. Distribution of species in different families

Results and Discussion

In this study, we conducted interviews with a total of 45 informants, consisting of 27 males and 18 females. These informants were divided into four age groups: 30-40, 40-50, 50-60, and over 60. It is worth noting that the highest number of informants belonged to the over-60 age group. Additionally, we recorded the education qualifications of the informants, revealing that the majority of them were people with no formal education (62.96%), followed by primary education i.e., class 1st to 5th (44.44%), middle education i.e., class 6th to 8th (38.89%), matriculation (31.48%), and above matriculation (22.22%). The demographic data and multiple studies, including Pangging *et al.* (2018), Sahu *et al*. (2013), Sharma *et al*. (2012), Sharma and Pegu (2011), consistently suggest that older individuals and those with lower education levels such as people that have no formal education and primary level education tend to have a greater propensity for holding sacred and magico-religious beliefs associated with plants. This pattern indicates a correlation between age, education level, and the prevalence of these beliefs.

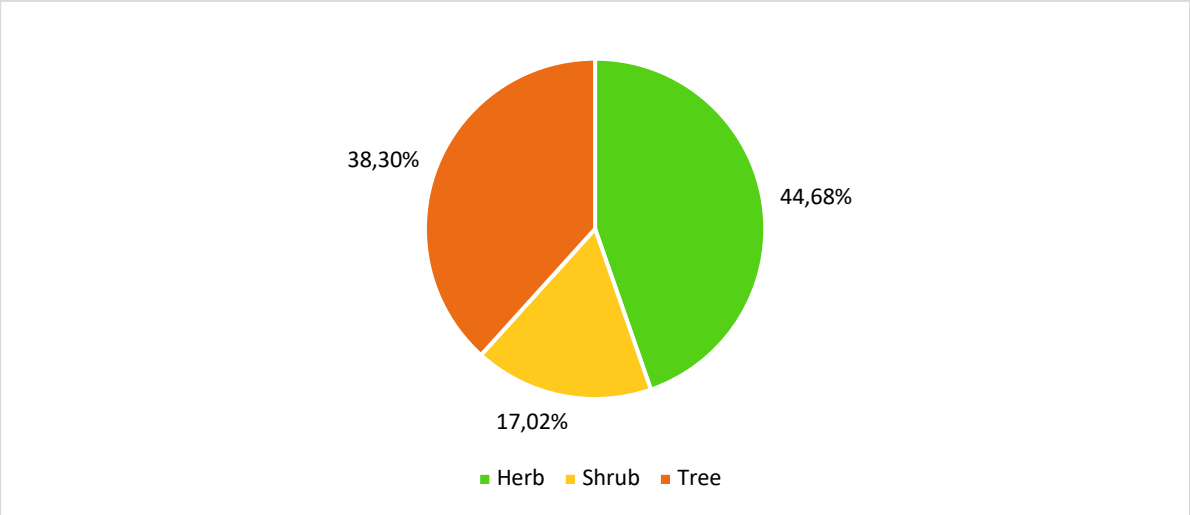

Figure 3. Life forms of plants used for sacred and magico-religious purposes

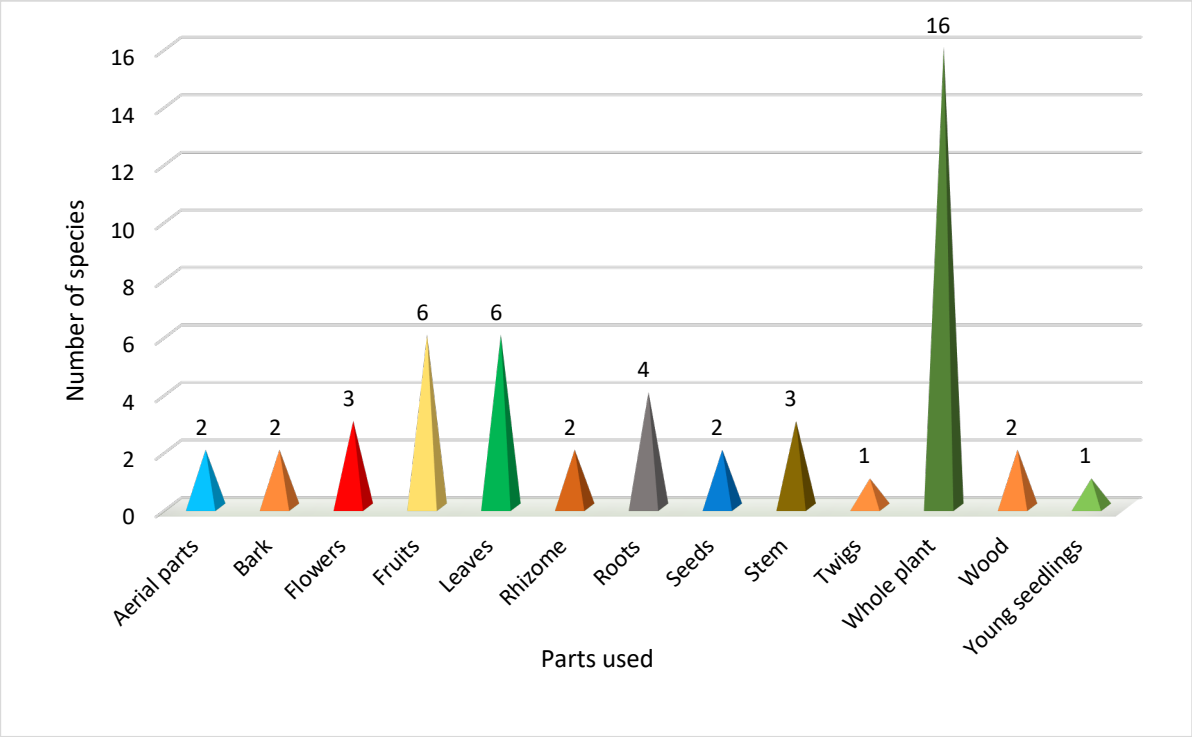

Figure 4. Histogram showing number of plant parts used for magico-religious purposes

We documented a total of 47 plant species belonging to 27 families. The most abundant plant species belonged to the families Asteraceae, Rosaceae, and Rutaceae (4 species each), followed by Moraceae and Poaceae (3 species each). Other families represented in the study included Amaranthaceae, Apiaceae, Caprifoliaceae, Cupressaceae, Malvaceae, Pinaceae, and Solanaceae (2 species each). Furthermore, Acoraceae, Anacardiaceae, Betulaceae, Boraginaceae, Brassicaceae, Cannabaceae, Juglandaceae, Lythraceae, Meliaceae, Oleaceae, Sapindaceae, Scrophulariaceae, Taxaceae, Verbenaceae, and Zingiberaceae were represented by one species each (Fig. 2). Interestingly, a study conducted by Pangging *et al.* (2018) on the Khampati tribe of the Assam district reported a total of 48 plant species belonging to 44 genera and 30 families used for magico-religious purpose.

Several other studies have indicated that the Poaceae family is the most commonly used plant family for magical beliefs among various tribes in India (Ahirwar 2015, Pangging *et al*. 2018, Sarma 2015, Sharma *et al*. 2012). The dominance of Poaceae family over other families in different studies is due to the reason that most cereals and many grasses are considered holy by the local communities and used for cultural and religious purposes. They symbolize purity, sanctity, and auspiciousness in different traditions. In the present study, *Cynodon dactylon*, *Eulaliopsis binata*, and *Hordeum vulgare* are used for different ceremonies. In our study area, it is evident that a single family does not serve as the sole cultural index; instead, three families demonstrate dominance. This finding suggests that people unknowingly contribute to the in-situ conservation of a large population of plants.

In our study, out of the 46-plant species documented, of which 21 spp are herbs (44.68%), 18 spp of trees (38.30%), and 8 spp of shrubs (17.02%), as depicted in Figure 3. Notably, the worship of herbs is a prevalent practice in the study area, while tree worship is also significant, with 18 species being associated with religious practices. Sinha (1979), Gupta (1980), Sane and Ghate (2006), Sahu *et al*. (2013), Agarwal (2014), Sharma *et al.*(2014), Pandey and Pandey (2016), Singhal *et al.*(2017), Thakur *et al.* (2021) and Thakur *et al.* (2023) supports the notion that tree worship is more commonly observed as a religious practice. Regarding the plant parts used in religious practices, the study found that the most commonly utilized plant part was the whole plant of 16 species. Fruits and leaves were the next most frequently used plant parts, taken from 6 species, followed by roots of 4 species. Flowers and stems were picked from 3 species, while aerial parts, bark, rhizome, seeds, and wood were worshipped from each of 2 plant species. Whereas 1 sp. contribute twig and young seedlings (Fig. 4). The indigenous people in the study area offer various plant parts such as bark, leaves, flowers, and fruits to different deities as part of their religious rituals. It is noteworthy that each deity has specific offerings associated with it, which adds to the diversity of plant species preserved by these practices. Previous studies have shown that most of the lords are connected with specific plants they are believed to either reside in these plants or like different plants for worshiping. *Aegle marmelos* is connected to Lord Shiva, Lord Brahma is linked to *Ficus religiosa*. **Tulsi** (*Ocimum tenuifloruml*) is used in worshiping Lord Vishnu as per studies of Sahu *et al*. (2013), Pandey and Pandey (2016), Panging *et al*. (2018), Devi *et al*. (2020), Thakur *et al*. (2021), Thakur *et al*. (2023). In the present study, it is observed that *Cannabbis sativa* and *Datura stramonium* are offered to Lord Shiva and Tulsi is worshiped to revive Lord Vishnu. Furthermore, local deities are believed to inhabit or prefer different plants for their worshiping, and also the belief of that some plants are housed by evil spirits, therefore the movement of people around these plants is prohibited. These plants are not even grown in front of houses. This connection of each deity with specific plants and considering some plants as taboo plays an important role in maintaining the diversity of plants and in-situ conservation.

Table 4. Informant consensus factor (ICF) for different use categories

Use Categories	Sub-Categories	Nur	Nt	ICF
Magic beliefs (MAG)	Dhooni/ Dhoop/ Hawan/ Ward of evils spirits	177	23	0.88
Sacred (SAC)	Worshiping/ Offering	148	16	0.90
Social ceremonies (SC)	Various ceremonies	119	12	0.91
Taboos (TAB)	Restrictions	33	5	0.88

Table 5. Cultural importance index for each species under each use category CI Values

Plant Species	MAG	SAC	SC	TAB	CI (Total)
Achyranthes bidentata	0.18	0	0	0	0.18
Acorus calamus	0.22	0	0	0	0.22
Aegle marmelos	0	0.33	0	0	0.33

Artemisia nilagirica	0.16	0	0	0	0.16
Betula utilis	0.2	0	0	0	0.2
Bombax ceiba	0	0.18	0	0.16	0.34
Brassica rapa	0.22	0	0	0	0.22
Cannabis sativa	0	0.18	0.18	0	0.36
Capsicum annuum	0.18	0	0	0	0.18
Cedrus deodara	0	0.16	0	0	0.16
Citrus limon	0.18	0	0	0	0.18
Citrus medica	0	0	0.24	0	0.24
Curcuma longa	0	0	0.36	0	0.36
Cynodon dactylon	0	0	0.4	0	0.4
Datura stramonium	0	0.16	0	0	0.16
Deeringia amaranthoides	0	0.11	0	0	0.11
Dolomiaea macrocephala	0.22	0	0	0	0.22
Eulaliopsis binata	0	0	0.24	0	0.24
Ficus carica	0	0.18	0	0.13	0.31
Ficus palmata	0	0.18	0	0.13	0.31
Ficus religiosa	0	0.31	0	0	0.31
Hordeum vulgare	0	0.22	0.22	0	0.44
Hymenolaena candollei	0.16	0	0	0	0.16
Jasminum officinale	0	0	0.16	0	0.16
Juglans regia	0	0.2	0	0.18	0.38
Juniperus indica	0.16	0	0	0	0.16
Juniperus recurva	0.22	0.18	0	0	0.4
Mangifera indica	0	0	0.24	0	0.24
Melia azedarach	0.13	0	0	0	0.13
Morina longifolia	0.18	0	0	0	0.18
Ocimum tenuiflorum	0	0.36	0	0	0.36
Onosma hispida	0	0	0.16	0	0.16
Pinus roxburghii	0.2	0	0	0	0.2
Prinsepia utilis	0.18	0	0.13	0	0.31
Prunus cerasoides	0	0	0.11	0	0.11
Prunus persica	0.18	0	0	0	0.18
Punica granatum	0	0	0.2	0	0.2
Pyrus pashia	0	0.16	0	0.13	0.29
Sapindus mukorossi	0.13	0	0	0	0.13
Saussurea gossipiphora	0.16	0	0	0	0.16
Selinum vaginatum	0.11	0	0	0	0.11
Taxus contorta	0.13	0	0	0	0.13
Tegetes erecta	0	0.22	0	0	0.22
Valeriana jatamansi	0.16	0	0	0	0.16
Verbascum thapsus	0.13	0	0	0	0.13
Vitex negundo	0.16	0	0	0	0.16

Zanthoxylum armatum	0	0.18	0	0	0.18

We categorized the magico-religious beliefs into four categories as per Pangging *et al*. (2018) with required modifications: magic beliefs (MAG), sacred (SAC), social ceremonies (SC), and taboos (TAB) (Table 2). The use of plants in making "Dhooni," "Dhoop," "Hawan," and "Ward off evil spirits" were grouped under the magic beliefs category. Worshiping and offering plants and plant parts were classified under the sacred use category. Plants used in various social ceremonies were included in the social ceremonies category, and certain plants associated with restricted beliefs were categorized as taboos.

Table 6. Evaluation of plants using four quantitative indices and ranking of each species based on each index

Botanical Name	Basic values			Indices				Ranking			
	FC	UR	NU	RFC	CI	RI	CV	RFC	CI	RI	CV
Achyranthes bidentata	8	8	1	0.18	0.18	0.47	0.008	25	25	25	25
Acorus calamus	10	10	1	0.22	0.22	0.53	0.012	18	18	18	18
Aegle marmelos	15	15	1	0.33	0.33	0.67	0.028	4	9	13	13
Artemisia nilagirica	7	7	1	0.16	0.16	0.44	0.006	31	31	31	31
Betula utilis	9	9	1	0.20	0.2	0.50	0.010	22	22	22	22
Bombax ceiba	13	15	2	0.29	0.34	0.86	0.048	7	8	2	4
Brassica rapa	10	10	1	0.22	0.22	0.53	0.012	19	19	19	19
Cannabis sativa	12	16	2	0.27	0.36	0.83	0.047	10	5	5	5
Capsicum annuum	8	8	1	0.18	0.18	0.47	0.008	26	26	26	26
Cedrus deodara	7	7	1	0.16	0.16	0.44	0.006	32	32	32	32
Citrus limon	8	8	1	0.18	0.18	0.47	0.008	27	27	27	27
Citrus medica	11	11	1	0.24	0.24	0.56	0.015	14	15	15	15
Curcuma longa	16	16	1	0.36	0.36	0.69	0.032	2	6	11	11
Cynodon dactylon	18	18	1	0.40	0.4	0.75	0.040	1	2	10	8
Datura stramonium	7	7	1	0.16	0.16	0.44	0.006	33	33	33	33
Deeringia amaranthoides	5	5	1	0.11	0.11	0.39	0.003	45	45	45	45
Dolomiaea macrocephala	10	10	1	0.22	0.22	0.53	0.012	20	20	20	20
Eulaliopsis binata	11	11	1	0.24	0.24	0.56	0.015	15	16	16	16
Ficus carica	12	14	2	0.27	0.31	0.83	0.041	11	10	6	6
Ficus palmata	12	14	2	0.27	0.31	0.83	0.041	12	11	7	7
Ficus religiosa	14	14	1	0.31	0.31	0.64	0.024	5	12	14	14
Hordeum vulgare	14	20	2	0.31	0.44	0.89	0.069	6	1	1	1
Hymenolaena candollei	7	7	1	0.16	0.16	0.44	0.006	34	34	34	34
Jasminum officinale	7	7	1	0.16	0.16	0.44	0.006	35	35	35	35
Juglans regia	13	17	2	0.29	0.38	0.86	0.055	8	4	3	3
Juniperus indica	7	7	1	0.16	0.16	0.44	0.006	36	36	36	36
Juniperus recurva	13	18	2	0.29	0.4	0.86	0.058	9	3	4	2
Mangifera indica	11	11	1	0.24	0.24	0.56	0.015	16	17	17	17
Melia azedarach	6	6	1	0.13	0.13	0.42	0.004	41	41	41	41
Morina longifolia	8	8	1	0.18	0.18	0.47	0.008	28	28	28	28
Ocimum tenuiflorum	16	16	1	0.36	0.36	0.69	0.032	3	7	12	12
Onosma hispida	7	7	1	0.16	0.16	0.44	0.006	37	37	37	37
Pinus roxburghii	9	9	1	0.20	0.2	0.50	0.010	23	23	23	23
Prinsepia utilis	11	14	2	0.24	0.31	0.81	0.038	17	13	9	10

Prunus cerasoides	5	5	1	0.11	0.11	0.39	0.003	46	46	46	46
Prunus persica	8	8	1	0.18	0.18	0.47	0.008	29	29	29	29
Punica granatum	9	9	1	0.20	0.2	0.50	0.010	24	24	24	24
Pyrus pashia	12	13	2	0.27	0.29	0.83	0.039	13	14	8	9
Sapindus mukorossi	6	6	1	0.13	0.13	0.42	0.004	42	42	42	42
Saussurea gossipiphora	7	7	1	0.16	0.16	0.44	0.006	38	38	38	38
Selinum vaginatum	5	5	1	0.11	0.11	0.39	0.003	47	47	47	47
Taxus contorta	6	6	1	0.13	0.13	0.42	0.004	43	43	43	43
Tegetes erecta	10	10	1	0.22	0.22	0.53	0.012	21	21	21	21
Valeriana jatamansi	7	7	1	0.16	0.16	0.44	0.006	39	39	39	39
Verbascum thapsus	6	6	1	0.13	0.13	0.42	0.004	44	44	44	44
Vitex negundo	7	7	1	0.16	0.16	0.44	0.006	40	40	40	40
Zanthoxylum armatum	8	8	1	0.18	0.18	0.47	0.008	30	30	30	30

In our studied area, the practice of burning "Dhooni" is an ancient tradition still prevalent in households as a means to ward off evilness or impurities. Natives use plants such as *Achyranthes bidentata*, *Artemisia nilgirica*, *Betula utilis*, *Salinum vaginalum*, and *Verbascum thapasus* in the form of smoky flames to purify the atmosphere whenever they feel unwell or unsafe. Despite modernization, the lifestyle of these tribal people remains largely unaffected, and they continue to employ traditional methods such as burning plant sticks (*Dolomiaea macrocephala*, *Morina longifolia*, *Valeriana jatamansi*) as incense to appease local deities. Superstitions and old beliefs persist among the local population, and pregnant women are forbidden from coming into proximity with certain religious plants such as *Ficus carica*, *Ficus palmata*, *Juglans regia*, and *Pyrus pashia*.

The social ceremonies (SC) use category was the maximum informant consensus factor (0.91) followed by the Sacred (SAC) use category (0.90) and Magic beliefs (MAG) & taboos (TAB) (0.88) (Table 4). It means the information about the uses of the plant in social ceremonies was shared among the people in the study area.

The study assessed various quantitative indices, including Relative Frequency of Citation (RFC), Cultural Importance Index (CI), Relative Importance (RI), and Cultural Value Index (CV), to compare and rank the plant species based on their cultural significance. The results are presented in Tables 5 and 6. The highest cultural importance index in the magic beliefs (MAG) category has been found for four species *Acorus calamus, Brassica rapa, Dolomiaea macrocephala* and *Juniperus recurva* (0.22). It is followed by *Betula utilis* and *Pinus roxburghii* (0.2) while *Selinum vaginatum* (0.11) with lowest CI. *Ocimum tenuiflorum* has the highest CI (0.36) in the sacred (SAC) category followed by *Aegle marmelos* (0.33), *Ficus religiosa* (0.31), *Hordeum vulgare,* and *Tegetus erecta* (0.22) and 0.11 (least) for *Deeringia amaranthoides*. In the social ceremonies (SC) category *Cynodon dactylon* (0.4) have the maximum cultural importance index followed by *Curcuma longa* (0.36), *Citrus medica*, *Eulaliopsis binate,* and *Mangifera indica* (0.24 for each). *Prunus cerasoides* CI (0.11) in this category. *Juglans regia* (0.18)were the highest CI in the taboos (TAB) use category followed by *Bombax ceiba* (0.16) and 0.13 (least) CI for *Ficus carica, F. palmata,* and *Pyrus pashia*. *Cynodon dactylon* obtained the highest RFC value of 0.40, indicating that it was frequently cited by a large number of informants. It ranked first in RFC since RFC is solely dependent on the frequency of citation, irrespective of the number of uses. *Hordeum vulgare*, with a CI of 0.44, RI of 0.89, and CV of 0.069, secured the top rank in terms of cultural importance. *Juniperus recurva* ranked second in the CV index, while *Juglans regia* ranked third. In terms of the RI index, *Bombax ceiba* and *Juglans regia* occupied the second and third positions, respectively. *Selinum vaginatum* ranked last (47th) in all four indices due to its inclusion in only one-use category with a minimum frequency of citation.

Comparisons with previous studies revealed that certain plant species, such as *Cannabis sativa, Curcuma longa, Datura stramonium, Ficus religiosa, Mangifera indica, Aegle marmelos, Cynodon dactylon,* and *Musa species*, were religiously protected and conserved throughout India. These findings align with the results of previous studies conducted by Ahirwar (2015), Pandey and Pandey (2016), Pangging *et al.*(2018), Sahu *et al*. (2013), Sarma (2015), Sharma *et al*. (2014).

The conservation of these plants by tribal communities based on superstitions and religious beliefs has been practiced for centuries. It is noteworthy that many of these plants possess medicinal properties and are used to treat various diseases. Therefore, their conservation through these beliefs is beneficial for society as a whole. Shekhar and Badola (2000) suggest that plants with significant medicinal value hold a prestigious place in socio-economic and religious contexts. Sharma *et al*. (2012) also identified 36 medicinal-religious plants in the Hajong community in Assam. Similarly, in this study, several plant species with high CI values, such as *Aegle marmelos*, *Acorus calamus*, *Brassica rapa*, *Curcuma longa*, *Ocimum tenuiflorum*, *Dolomiaea macrocephala*, and *Juniperus recurva* were found to have medicinal importance in different categories. Thus, the conservation efforts driven by magico-religious beliefs contribute to the sustainable preservation of these valuable medicinal species. The IUCN red list status of documented plant species is varied in present study. It is found that 25 plant species of our study are not found in the IUCN online database. Other data shows that 20 spp are as least concern (LC), one is endangered (*Taxus contorta*) and one is near threatened (*Aegle marmelos*) in Table 3 (IUCN 2023). Further, for Himachal Pradesh, two species are found critically endangered (*Dolomiaea macrocephala* & *Saussurea gossypiphora*), three are endangered (*Betula utilis*, *Taxus contorta* & *Zanthoxylum armatum*) and two species are vulnerable (*Selinum vaginatum* & *Valeriana jatamansi*) (Gowthami *et al*. 2021, ENVIS centre on medicinal plants 2023). These sacred plants have been reported for medicinal value in the last decades. High medicinal formulation practices became the reason for their overexploitation and some plants are under the core threat of being extinct and endangered. Lack of awareness among the locals for harvesting of wild medicinal plants is a major cause of threatened plants. So, proper awareness should be created among the local people for the seasonal exploitation of plants.

Some ways of plant conservation are:
The identification and establishment of a growing number of sacred groves, where particular plants are considered sacred, is a way through which communities will get involved in conservation of medicinal plants.

Educating young people about the historical significance of sacred plants and their contribution for biodiversity conservation by involving religious leaders and local practitioners can support the plant conservation.

Plants conservation for religious and cultural purposes can be greatly aided by promoting the ethical collection of plants for a variety of social and religious rituals with the cooperation of ecotourism and cultural activities.

The correct education of people about the usefulness of plant diversity. The involvement of women can be beneficial for working on plant-saving ideas as they are more faithful to the worshiping of plants. Revival of sacred groves and taboo beliefs will play an important role in biodiversity conservation.

These types of initiatives can develop a respect for sacred nature among the populace and contribute to local conservation efforts.

Conclusion

In summary, this study reveals the following key findings:
Older individuals and those with lower education levels demonstrate a higher prevalence of sacred and magico-religious beliefs associated with plants. A diverse range of plant species from various families were documented, emphasizing the significance of cultural practices in preserving plant diversity. Worship of herbs (21 spp) is a common practice, but tree worship (18 spp) has also good impact in the study area. The whole plant, fruits, and leaves are the most commonly used plant parts in religious practices. Magico-religious beliefs were categorized into magic beliefs, sacred practices, social ceremonies, and taboos. Social ceremonies had the highest consensus factor among informants, indicating the widespread sharing of information about plant uses in these ceremonies. Conservation of certain plant species based on religious beliefs is observed across India, contributing to biodiversity preservation and traditional knowledge. The conservation efforts driven by magico-religious beliefs also benefit medicinal species, which play a significant role in socio-economic and religious contexts. The study underscores the importance of integrating cultural values and practices into conservation strategies.

These findings enhance our understanding of the relationship between human beliefs, plant utilization, and the preservation of plant diversity. They emphasize the need for further research in this field and the importance of respecting and valuing indigenous cultural traditions. Ultimately, such insights can contribute to the development of effective and culturally sensitive conservation approaches. Further studies can delve into the ecological and socio-economic aspects of these plants to develop effective conservation strategies that integrate cultural values and practices.

Declarations

***List of abbreviations*:** H- Herb, S- Shrub, T-Tree, AP- Aerial parts, Bk- Bark, Fl- Flowers, Fr- Fruits, Lf- Leaves, Rh- Rhizome, Rt- Roots, Sd- Seeds, St- Stem, Tw-Twigs, WP- Whole plant, Wd- Wood & YS-Young seedlings, MAG- Magic beliefs, SAC- Sacred, SC- Social ceremonies & TAB- Taboos.

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Literature cited

Addis G, Urga K, Dikkasol D. 2005. Ethnobotanical study of edible wild plants in some selected districts of Ethiopia. Human Ecology 33(1):83-118.

Agarwal P. 2014. Study of sacred plants used by people in Fatehpur district of Uttar Pradesh (India). Life Sciences Leaflets 54:91-98.

Ahirwar RK. 2015. Indigenous knowledge of Traditional Magico-religious believes plants of district Anuppur, Madhya Pradesh, India. American Journal of Ethnomedicine 2(2):103-109.

Bah S, Diallo D, Dembele S, Paulsen BS. 2006. Ethnopharmacological survey of plants used for the treatment of schistosomiasis in Niono District, Mali. Journal of Ethnopharmacology 105:387-399.

Devi K, Samant SS, Puri S, Singh A. 2020. Diversity, distribution pattern and traditional knowledge of sacred plants in Kanawar Wildlife Sanctuary (KWLS), Himachal Pradesh, Northwestern Himalaya. Indian Journal of Traditional Knowledge 19(3):642-651.

Dolores M, Tongco C. 2007. Purposive Sampling as a tool for informant Selection. Ethnobotany Research & Applications 5:147-158.

Envis Centre on Medicinal Plants. 2016. Database. https://envis.frlht.org/mpcc-species (Accessed 10/11/2023).

Gowthami R, Sharma N, Pandey R, Agrawal A. 2021. Status and consolidated list of threatened medicinal plants of India. Genetic Resources and Crop Evolution 68:2235-2263.

Gupta SS. 1980. Sacred Trees Across cultures and Nations: A New Search for Greater Understanding of Tradition, Religious Symbols, Medicinal Plants, and the Tree of Life from Socio-folkloro-logical Points of View. Indian Publications, Folklore Series, Calcutta, India.

Hajra PK, Rao RR, Singh DK, Uniyal BP. 1996. Flora of India. BSI, Calcutta, India.

Hammiche V, Maiza K. 2006. Traditional medicine in Central Sahara: pharmacopoeia of Tassili Najjer. Journal of Ethnopharmacology 105:358-367.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: healers' consensus and cultural importance. Social Science & Medicine 47(11):1859–1871.

International Society of Ethnobiology. 2023. Database. http://ethnobiology.net/code-of-ethics/ (Accessed 10/11/2023).

Jain SK, Mudgal V. 1999. A handbook of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun, India.

Jain SK, Rao RR. 1977. Handbook of field and herbarium methods. Today's and Tomorrow Printer & Publisher, New Delhi, India.

Jarvis MC, Miller AM, Sheahan J, Ploetz K, Ploetz J, Watson RR, Ruiz MP, Villapan CAP, Alvarado JG, Ramirez AL, Orr B. 2004. Edible wild mushrooms of the Cfre de Perote Region, Veracruz, Mexico: an ethnomycological study of common names and uses. Economic Botany 58:S111-115.

Manilal KS. 1989. Linkages of ethnobotany with other sciences and disciplines. Ethnobotany 1(1):15–24.

Martinez-Romero MM, Castro-Ramirez, Macario P, Fernandez JC. 2004. Use and availability of craft vines in the influence zone of the biosphere reserve Sian Kaan Quintana Roo, Mexico. Economic Botany 58(1):83-97.

Pandey D, Pandey VC. 2016. Sacred plants from ancient to modern era: Traditional worshipping towards plants conservation. Tropical Plant Research 3(1):136-141.

Pangging G, Sharma CL, Sharma M. 2018. Ethnobotanical studies of magico-religious plants with reference to Khampti tribe. International Journal of Life Sciences Research 6(2):196-202.

Plants of the World Online. 2023. Database. http://www.plantsoftheworldonline.org/ (Accessed 10/11/2023).

Rahman Q, Nadeem MS, Umair M, Altaf M, Ni J, Abbasi AM, Jameel MA, Pieroni A, Hamed MH, Ashraf S, Sadaf T. 2022. Medicinal waterbirds in the traditional healthcare system: an assessment of biodiversity- cultural linkages in Eastern Khyber Pakhtunkhwa, Pakistan. Journal of Ethnobiology and Ethnomedicine 18(57):1-19.

Ramanayya VN. 1985. Sacred plants: an essay on the origin of the South Indian Temple. Asian Education Services, New Delhi, India.

Ravishankar T. 1996. Role of indigenous people in the conservation of plant genetic resources. In: Jain SK. (eds). Ethnobotany in Human Welfare. Deep Publications, New Delhi, India, Pp. 310-314.

Sahu PK, Kumari A, Sao S, Singh M, Pandey P. 2013. Sacred plants and their Ethno-botanical importance in central India: A mini review. International Journal of Pharmacy and Life Sciences 4(8):2910-2914.

Sane H, Ghate V. 2006. Sacred conservation practices at species level through tree worship. Ethnobotany 18:46–52.

Sarma J, Devi A. 2015. Study on traditional worshiping plants in Hindu religion from Nalbari and Sonitpur districts of Assam. International Journal of Scientific and Research Publications 5(5):1-5.

Sharma M, Sharma CL, Debbarma J. 2014. Ethnobotanical studies of some plants used by Tripuri tribe of Tripura, NE India with special reference to magico-religious beliefs. International Journal of plant, animal and environmental sciences 4(3):518-528.

Sharma UK, Pegu S. 2011. Ethnobotany of religious and supernatural beliefs of the Mising tribes of Assam with special reference to the 'DoburUie'. Journal of ethnobiology and ethnomedicine 7:1-13.

Sharma UK, Pegu S, Hazarika D, Das A. 2012. Medico-religious plants used by the Hajong community of Assam, India. Journal of Ethnopharmacology 143(3):787–800.

Shekhar CS, Badola R. 2000. Medicinal plant cultivation and sustainable development: a case study in the Buffer Zone of the Nanda Devi Biosphere Reserve, Western Himalaya, India. Mountain research and development 20(3):272-279.

Silva AJ, Andrade LHC. 2006. Cultural significance of plants in communities located in the coastal forest zone of the state of Pernambuco, Brazil. Human Ecology 34:447-465.

Singh H, Sharma M. 2006. Flora of Chamba District (Himachal Pradesh). Bishen Singh Mahendra Pal Singh, Dehradun, India.

Singhal P, Shivanee DP. 2017. Ethnobotanical studies on the religious plants of Sounla village of district Tehri Garhwal. International Journal of Advance Research 5(5):833-839.

Sinha BC. 1979. Tree worship in Ancient India. East West Publications, London, England.

Sood SK, Thakur V, Lakhanpal TN. 2005. Sacred and Magico-religious Plants of India. Scientific Publishers, Jodhpur, India.

Thakur S, Jamwal R, Negi S. 2023. Ethnobotanical survey of plants used in magico-religious practices in Kullu district of Himachal Pradesh, India. Ethnobotany Research & Applications 25:1-18.

Thakur S, Singh S, Dutt HC. 2021. Some plant related magico-religious beliefs among people of Doda district of Jammu and Kashmir, India. Pleome 15(3):439-447.

Tardio J, Pardo-de-Santayana M. 2008. Cultural Importance Indices: A Comparative Analysis Based on the Useful Wild Plants of Southern Cantabria (Northern Spain). Economic Botany 62(1):24-39.

The IUCN Red List of Threatened Species. 2023. Database. https://www.iucnredlist.org (Accessed 10/11/2023).

The World Flora Online. 2023. Database. http://www.worldfloraonline.org/. (Accessed 10/11/2023).

Waheed M, Haq SM, Arshad F, Jameel MA, Siddiqui MH, Bussmann RW, Manshoor N, Alamri S. 2023. Where Will Threatened *Aegle marmelos* L., a Tree of the Semi-Arid Region, Go under Climate Change? Implications for the Reintroduction of the Species. Land 12(7):1-19.