



Plants used for magico-religious purposes by the indigenous communities of sub-Himalayan Tract, Uttarakhand

Jyotsana Sharma, Kanwaljeet Singh and Sumeet Gairola

Correspondence

Jyotsana Sharma¹, Kanwaljeet Singh² and Sumeet Gairola^{2*}

¹CSIR-IIIM Residential complex, Jammu, 180001, J&K, India

²Plant Sciences Division, CSIR-Indian Institute of Integrative Medicine, Canal Road, Jammu- 180 001, J&K, India

*Corresponding Author: sumeetgairola@iiim.res.in

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Research

Abstract

Background: Plants play an essential role in every rural society's cultural and religious ceremonies. The focus of the study was to document the use of plants by the indigenous communities of sub-Himalayan Tract, Uttarakhand in magico-religious practices.

Method: Information was extracted from eighty informants (50 men; 30 women) between 25 to 75 years of age. A semi-structured questionnaire, interviews, and participatory observations were made to collect data from the informants to meet the study's requirements.

Results: The present study revealed 34 plants belonging to 31 genera and 25 families for the magico-religious practices. Fruits and whole plants are mainly used to conduct various social and religious practices, such as offerings in religious ceremonies. Herbs (59%) were the dominant forms, and wastelands (48%) were the dominant source of magico-religious plants. High Informant Consensus Factor (Fic) was recorded for the plants used in the sacred and religious rites (SAR) category. Species such as *Datura stramonium*, *Ocimum tenuiflorum*, *Ficus benghalensis*, *Cynodon dactylon*, *Achyranthes aspera*, and *Calotropis procera* were culturally most important based on cultural index value.

Conclusion: The plant species play a vital role in practicing the religion and culture among the studied communities. Therefore, it is suggested that the indigenous communities of the sub-Himalayan region be monitored and contacted regularly about their beliefs. They must be informed and made aware of the importance of plant diversity and the significant loss that will occur if it is lost.

Keywords: Uttarakhand, Indigenous communities, Magico-religious practices, Cultural Importance, Plants

Background

The Indian cultural heritage is diverse, and despite the incursion of contemporary culture, ancient festivals, reveres, customs, and rites continue to thrive among India's various ethnic communities (Sharma *et al.* 2012). Plants are significant natural resources that offer material and magical cultural necessities such as housing, clothing, food, and tools (Pangging *et al.* 2021). In India, several gods and goddesses are revered by different religious beliefs. In

Hinduism, there is a profound belief that God has bestowed divine properties on some plants, which are then employed in ceremonies and combinations to treat human ailments (Luximon *et al.* 2019). Plants play an essential role in every rural society's social and religious ceremonies (Manilal 1989). There are numerous examples of traditional plant worship in many parts of the world, spanning all religious and belief systems (Karangi 2008; Niroula & Singh 2015; Luo *et al.* 2020; Dafni 2007).

Plants are revered by tribals and aborigines, who utilize them in their rituals (Sharma & Pegu 2011). It has been observed that people's strong religious beliefs in sacred plants and groves have aided in the conservation of plant species in several regions (Ray & Ramachandra 2010). Plant worship or the concept of plants as abodes of God as an element of traditional culture entails a profound ecological implication and a rich materialist philosophy concerning human-plant relations (Sharma *et al.* 2012).

There are 468 sacred and magical plants in India, belonging to 133 families and 340 genera (Sood *et al.* 2005). Several plants are usually associated with Hindu gods and goddesses. In India, for example, the plants' *Ficus religiosa* L. and *Aegle marmelos* L. Corr. are revered as major symbols of Vishnu and Shiva, respectively (Ramanayya 1985). Different plant parts were worn as pendants that were said to cure a variety of maladies and diseases, protect the wearer from evil spirits, and provide good luck (Singh & Singh 1996). Indigenous knowledge about these plants' magical, religious, and medicinal applications must be documented for conservation efforts to be successful (Singh *et al.* 2011). The medicinal plants' biodiversity is revered in local cultures' religious and socio-economic activities, where they are worshipped as gods, goddesses, and other idols (Silori & Badola 2000). Traditional herbalists hold the firm notion that medicinal herbs cannot be as successful as they should be unless they are treated with respect (Sharma *et al.* 2012).

Uttarakhand is situated in the eastern part of the North-West Himalaya and lies between 28° 43' and 31° 27' north latitudes and 77° 34' and 81° 02' east longitudes with an altitudinal range of 200 to more than 6000 m above mean sea level. The state is divided into two administrative divisions: Kumaon and Garhwal. The topography of the state is highly diversified which includes deep valleys, lofty peaks, glaciers, perennial lakes and streams (Mahapatra *et al.* 2018). Physio-graphically, Uttarakhand is divided into three zones, namely, Terai region, the Shiwalik, and the Himalaya. The sub-Himalayan region of Uttarakhand is home to several tribes like Bhoja, Gujjar, Tharu, Raji, and Jaunsari (Sharma *et al.* 2013). The medicinal potential of the flora of this region has been explored periodically in several studies (Sharma *et al.* 2011, 2012; Gairola *et al.* 2013; Sharma *et al.* 2014; Dutt *et al.* 2015; Khahuria *et al.* 2021; Mir *et al.* 2021; Jan *et al.* 2022). Although various research groups documented different plants used in magico-religious proposes from various parts of India (Prمود *et al.* 2003; Dinesh 2010; Sharma *et al.* 2011; Kushwah *et al.* 2017; Pangging *et al.* 2021), information on the use of plants used for the same in this Sub-Himalayan tract is scarce. As a result, there was a need to document the plant species employed by indigenous communities in the region in magico-religious rites, which could be jeopardized owing to urbanization and the death of elderly knowledgeable individuals.

Material and Methods

Study area

The sub-Himalayan tract of Uttarakhand runs along the state's southern border and is made up of a series of narrow, low-altitude mountain ranges. It is located 300-1000 meters above sea level and is a transitional zone between the Gangetic plains and the Himalayas (Sharma *et al.* 2013). This zone is a rich repository of biodiversity, owing to its complex topography and harbors a wide variety of plants, annuals and perennials, herbs, grasses, and cryptogams (Gaur *et al.* 2010). The present investigation was conducted in the districts of Tehri Garhwal (30°17'N-78°31'E), Pauri Garhwal (30°09'N-78°46'E), Dehradun (30°19'N-78°04'E) and Haridwar (29°96'N-78°16'E) (Figure 1). The average annual rainfall in the region ranged between 1184-1699 mm (<https://imdpune.gov.in>), and the average yearly temperature ranged from 30°C in the summer to 2°C in the winter (Pratap *et al.* 2020).

Tharu is Uttarakhand's largest primitive community, while Bhoja is the state's third-largest. Gujjars are one of the Himalayas' most important migratory communities, traveling to higher Himalayan meadows in the summer and monsoon and returning to the lower Himalayas in the winter. Except for the Gujjars, who practice Islam, Hinduism is the predominant religion among the residents of the studied region. Bhoja and Tharu communities speak Hindi, while Gujjar community speaks Gojri or Dogri however they understand Hindi as well. With 'Panchayats' in each hamlet, the Bhoja enjoy a democratic justice system. Each Panchayat has a leader known as the 'Pradhan,' whose decision is final. People from the Tharu community follow a traditional Panchayat system in which Panchayats' decisions are definitive. This community is divided into Ranas, Danguriyas, and Khunkas. The male and female

members of a Gujjar family are Lamberdarni and Lamberdarni, respectively. The literacy percentage in all three groups investigated was extremely low.

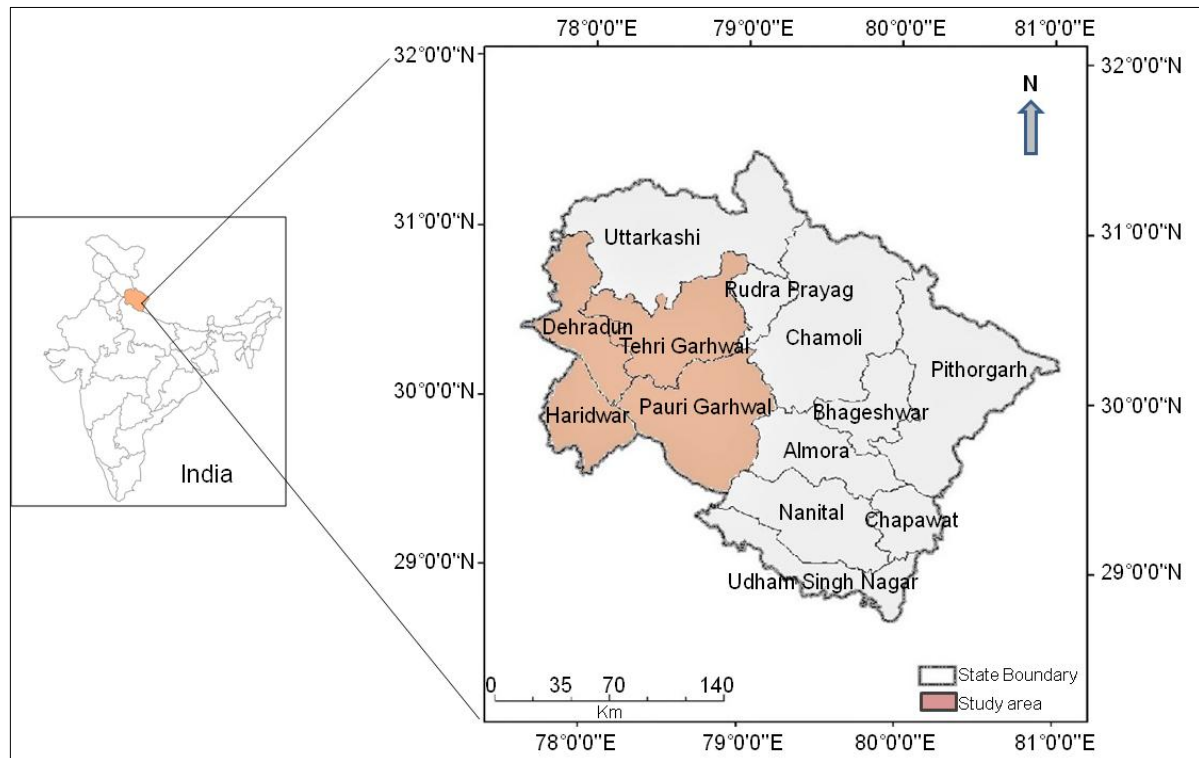


Figure 1. Map of the study area.

Data collection and analysis

Twenty-eight field visits were conducted in several villages in the study area from 2015 to 2020. These include Naggadi, Pathri Kisanpur, Gandikhata, Laldhang, and Chidiyapur in Haridwar district; Kunaohod, Rawasan, Chillagaon, Kumbhichod, Siggadi in district Pauri; Pathri in Dehradun; Bagi, Barnu, Bhanskoti, Bhudhogi, Dhang and Dhamri in district Tehri Garhwal. The study included eighty informants (50 men; 30 women) between 25 to 75 years of age (Table 1). Women were hesitant to provide the information; however, as the first author is native of the region, easy understanding and communication with the women resulted in collecting the most information possible. Prior verbal informed consent was taken from all the informants following CBD rules. A semi-structured questionnaire, interviews, and participatory observations were made to collect data from the residents to meet the study's requirements. Herbarium sheets of the collected plant species were prepared using the standard herbarium procedure (Jain & Rao 1977), and all the plant species were identified using regional flora (Gaur 1999). Accession numbers assigned to each plant specimen have been provided after the names of the individual species in Table 2. Valid botanical names with author citations of all the plant species were verified from <http://www.worldfloraonline.org/>. All the specimens were deposited in the Garhwal University Herbarium (GUH).

Table 1. Distribution of informants based on different age class and gender.

Variables	Category of Informants	No. of Informants
Gender	Male	50
	Female	30
Age class	Young (<35)	15
	Old (≥ 60 years)	40
	Adults (≥ 35 and <60 years)	25

Table 2. Documentation of the plants used for magico-religious purposes by the indigenous communities of Sub-Himalayan Tract, Uttarakhand.

Species name [Family] Accession number	Locality	Vernacular name	Flowering and Fruiting	Habit	Source	Plant part used	Use category	Magico-religious practices	UR	CI		Total CI
										MAG	SAR	
<i>Achyranthes aspera</i> L. [Amaranthaceae] GUH-JS 18893	Lamkhera	Ulta chirchita (B) Perkanda (G) Chattisa/Chircita (T)	Mar-Dec	H	W, R	St, Rt	MAG	The piece of stem is tied around women's breast for easy delivery (T) . A piece of root is tied around the neck of the sterile woman, believed in making her pregnant (B, T).	46	-	-	0.541
<i>Acorus calamus</i> L. [Araceae] GUH-JS 20355	Siggadi	Bacch (B, G) Papri (T)	Jun-Sept	H	M	Rt	MAG	The juice of roots is smeared on the body of children, believed in making them safe from diseases (G).	26	-	-	0.306
<i>Aegle marmelos</i> (L.) Correa [Rutaceae] GUH-JS 18837	Jaspur	Bel (B, G, T)	Feb-Aug	T	F, FL	Wp, Lf	SAR, MAG	The tree is considered sacred, and leaves are used for worship (48). The leaves are tied on the doors of the newly built house to avoid evil eyes (B, T) (10).	58	0.172	0.565	0.737
<i>Allium sativum</i> L. [Amaryllidaceae] GUH-JS 18889	Sehjani	Lehsun (B, T) Ganda/Thomb (G)	Apr-Jun	H	G	Bu	MAG	The bulbs are made into a garland and tied on the home door to ward off evil spirits (T).	34	-	-	0.400
<i>Blainvillea acmella</i> (L.) Philipson [Compositae] GUH-JS 20257	Ghosari	Sunhariya (G), Fuldu (T).	Apr-Nov	H	OP, AF	Wp	MAG	The plant is used to ward off evil spirits (G).	27	-	-	0.318
<i>Boerhavia diffusa</i> L. [Nyctaginaceae] GUH-JS 18845	Chidiyapur	Santi ghass/Puraniama (B) Peelia (G) Punarnava (T)	Aug-Dec	H	W, FL	Rt	MAG	The root pieces of 1 cm each are used as garland and tied around the neck of children who have jaundice, believed that the size of garland increases automatically as the disease cures, and it may take a few days (B). The same procedure is done for the treatment of jaundice in adults and children, and the	47	-	-	0.553

								roots are taken on Sunday morning. It is believed that if roots are taken on any other day, they become useless (G).				
<i>Calotropis gigantea</i> (L.) Dryand. [Apocynaceae] GUH-JS 20351	Pathri	Aankha (B, T) Aak (G) Madar (T)	Mar-Aug	S	W	Fl	SAR	The flowers are used in worship (B, T).	43	-	-	0.506
<i>Calotropis procera</i> (Aiton) Dryand. [Apocynaceae] GUH-JS 18896	Peerwala	Aakha (B) Aakwa (G) Aakauwa (T)	Apr-Aug	S	W	Fl	SAR	The flowers are offered to worship Lord Shiva (B, T).	48	-	-	0.565
<i>Cannabis sativa</i> L. [Cannabaceae] GUH-JS 20224	Nayagaon	Bhanglu (B) Bhang (G, T)	Aug-Oct	H	W, R	Lf	SAR	Leaves are used to worship Lord Shiva (B, T).	56	-	-	0.659
<i>Cayratia trifolia</i> (L.) Domin [Vitaceae] GUH-JS 18850	Gandikhata	Kaali bel (G)	May-Dec	H	F	St	MAG	A piece of the twig is tied around cattle's neck to relieve from worm-infested wounds, believed that as the animal cures, the piece of climber becomes dry (G).	26	0.306	-	0.306
<i>Celosia argentea</i> L. [Amaranthaceae] GUH-JS 19715	Malara	Salera (B) Gamla (G)	Aug-Dec	H	FL	Wp	MAG	The decoction of the whole plant is used to bath the baby after a week of birth; believed to save him from bad omen or effect of evil eyes (G).	21	-	-	0.247
<i>Cuscuta reflexa</i> Roxb. [Convolvulaceae] GUH-JS 19749	Kisanpur	Aakashbel (B) Andarbel (G) Sarai-babiya (T)	Jun-Dec	CL	F, W	St	MAG	The stem piece is tied around the neck of children suffering from fever (G).	27	-	-	0.318
<i>Cynodon dactylon</i> (L.) Pers. [Poaceae] GUH-JS 20293	Beeriya	Dubghass/Dubar (B) Dhoob (G, T)	Jan-Dec	H	W, G	Wp	SAR	Plant is believed sacred and used in religious ceremonies (B, T).	53	-	-	0.624
<i>Datura stramonium</i> L. [Solanaceae] GUH-JS 20364	Laldhang	Kala daturu (T) Dathura (B, G)	Feb-Aug	H	W, R	Fl, Sd	MAG, SAR	A small quantity of seed paste is mixed with water and orally given when cattle are scared by accidental reasons (G) (20). The flowers and fruits are used to worship Lord Shiva (B, T) (58).	78	0.235	0.682	0.918

<i>Desmostachya bipinnata</i> (L.) Stapf [Poaceae] GUH-JS 20303	Nakulia	Dubra (B) Sirun (G) Dubh (T)	Aug-Nov	H	RB	Wp	SAR	Plant is considered sacred and used in several religious ceremonies (B, T).	46	-	-	0.541
<i>Ficus benghalensis</i> L. [Moraceae] GUH-JS 18878	Karkata	Bad (B) Badopi (G) Bargad (T)	Mar-Oct	T	F	Wp, Lf	SAR, MAG	The tree is considered sacred and worshipped (38). The leaves are tied on the doors of the newly built house to avoid evil eyes (B, T) (16).	54	0.188	0.447	0.635
<i>Ficus religiosa</i> L. [Moraceae] GUH-JS 20366	Kalyanpur	Pipar (B) Badh (G) Peepal (T)	Apr-Sept	T	FL, F	Wp	SAR	The tree is considered sacred and used in worship (B, T).	58	-	-	0.682
<i>Globba marantina</i> L. Syn <i>Colebrookia oppositifolia</i> J.E. Smith [Lamiaceae] GUH-JS 20145	Rawasan	Bindu (B) Sambhalu (G) Durseli (T)	Jul-Sept	H	W, AF	St	MAG	Twigs are used in <i>Jhaar-phoonk</i> (psychomedicine) (G).	28	-	-	0.329
<i>Hibiscus rosa-sinensis</i> L. [Malvaceae] GUH-JS 20295	Malara	Gudhal (B) Kameliya (G)	Throughout the year	S	G	Fl	SAR	The flowers are used in worship (B).	46	-	-	0.541
<i>Mangifera indica</i> L. [Anacardiaceae] GUH-JS 20163	Sherpur	Aam (B, T) Amm (G)	Mar-July	T	G	Lf	SAR	The plant is sacred; leaves are used in religious ceremonies (B, T).	29	-	-	0.341
<i>Mallotus philippensis</i> (Lam.) Müll.-Arg. [Euphorbiaceae] GUH-JS 20148	Chidiyapur	Ruein (B) Kamela (G) Rohini (B, G, T)	Mar-Nov	T	R	Ba	MAG	The pieces of bark are cut made into rosary and tied around the neck of a person suffering from cholera (G).	29	-	-	0.341
<i>Mallotus repandus</i> (Willd.) Müll.-Arg. Syn <i>Trewia nudiflora</i> var. <i>dentata</i> Susila & N.P.Balacr. [Euphorbiaceae] GUH-JS 18804	Laldhang	Gutel (B) Bakhara (G) Ghiloor (T)	Jan-Nov	T	R, F, W	Fr	MAG	The fruits are used as garland and tied around the neck of children in scurvy (T).	17	-	-	0.200
<i>Martynia angulosa</i> Lam. Syn <i>Martynia annua</i> L. [Martyniaceae] GUH-JS 20105	Bhagori	Baagnakha (B) Manbidu (G) Bicchua (T)	Aug-Dec	H	W, R	Sd	MAG	The seeds are kept below the bed of a person who is scared in the night during sleeping (G).	32	-	-	0.376
<i>Mirabilis jalapa</i> L. [Nyctaginaceae] GUH-JS 20343	Tisoor	Gulbans (G, T)	Aug-Dec	H	W	Fl	SAR	The flowers are used in worship (T).	44	-	-	0.518

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<i>Musa balbisiana</i> Colla [Musaceae] GUH-JS 20333	Ghosari	Kela (B, G, T)	Throughout the year	H		Wp, Lf	SAR	The plant is considered sacred, and leaves are used in religious ceremonies (B, T).	41	-	-	0.482
<i>Ocimum tenuiflorum</i> L. [Lamiaceae] GUH-JS 20296	Aaduwala	Tulsi (B, T) Tulsia (G)	Apr-Nov	H	G	Wp	SAR	The plant is considered sacred and used in worship (B, T).	61	-	-	0.718
<i>Phoenix acaulis</i> Roxb. [Arecaceae] GUH-JS 20258	Rawasan	Khajuri (B, G)	Mar-Apr	T	F	Lf	SAR	The leaves are considered sacred used in a religious ceremony (B).	24	-	-	0.282
<i>Solanum surattense</i> Burm. f. [Solanaceae] GUH-JS 18898	Karkata	Chakmori (B) Kandyalu (G) Pili Kateli (T)	Almost throughout the year	H	W, R	Fr	MAG	The garland of 21 fruits is tied around a patient's neck with jaundice. It is believed that with the cure of the disease, the garland becomes loose and increases in size. The fruits are placed under the bed cover of the person who has jaundice, believing that there is automatic change in fruit color with the cure of disease (G).	21	0.247	-	0.247
<i>Stellaria media</i> (L.) Vill. [Caryophyllaceae] GUH-JS 20187	Chidiyapur	Seeton (G)	Jan-Jun	H	W, AF	Wp	SAR	Many plants are collected together, burnt, and smoke is sprayed to the person to remove the effect of evil spirits and bad omen. The plant juice is given orally to the children who appears to be scared (G).	18	-	-	0.212
<i>Tinospora sinensis</i> (Lour.) Merr. Syn <i>Tinospora cordifolia</i> (Willd.) Miers [Menispermaceae] GUH-JS 20354	Jaspur	Giloe (B, G) Gurech (T)	Jul-Dec	CL	F	St	MAG	The stem pieces are used as garland and tied around the neck of the patient suffering from jaundice and placed below the bed for the same (B, G).	37	-	-	0.435
<i>Typha domingensis</i> Pers. Syn <i>Typha angustata</i> Bory & Chaub. [Typhaceae] GUH-JS 20308	Ghosari	Patera (B) Banya (G) Pater (T)	Apr-Dec	H	M	Rt	MAG	The roots are rubbed and tied on children's necks to protect them from bad omen (G).	25	0.294	-	0.294

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<i>Vitex negundo</i> L. [Verbenaceae] GUH-JS 18836	Kisanpur	Sambhalu (B) Maala (G) Nirgndi (T)	Mar-Oct	S	F, W	Rt	MAG	<i>Kajal</i> is prepared from the roots of old plants (locally known as <i>Mamira</i>), which is applied on eyes to strengthen the vision power; the roots are taken on Thursday. An isolated single old plant grown in a shady place is tied with a white cotton cloth for seven days. Subsequently, the jaundice suffering patient covers the cloth at night to relieve the ailment (G).	34	0.400	-	0.400
<i>Xanthium strumarium</i> L. [Compositae] GUH-JS 18816	Malara	Birchita (B) Turmudi (G) Bada circita (T)	Jul-Dec	H	W, FL	Fr	MAG	A garland is prepared from 3 fruits and tied around the neck of children suffering from fever (G); the same is done for making children safe from bad omen (T).	43	-	-	0.506
<i>Ziziphus jujuba</i> Mill. Syn. <i>Ziziphus mauritiana</i> Lam. [Rhamnaceae] GUH-JS 20149	Sherpur	Ber (B) Jangli ber (G) Jangli beri (T)	Jun-Dec	S	W	Fr	SAR	The fruits are offered to Lord Shiva (B, T).	41	-	-	0.482

Abbreviations: Habit: H-Herb; S-Shrub; T-Tree; CL-Climber. Source: AF-Agricultural field; F-Forest; FL-Farm land; G-Garden; M-Marshy; OP-Open pasteurs; RB- River bank;W-Wasteland. Plant part used: Fr-Fruit; Wp-Whole plant; Lf-Leaf; St-Stem; Rt-Root; Fl-Flower; Sd-Seed; Ba-Bark; Bu-Bulb. Use category: SAR-Sacred and Religious; MAG-Magical. Community: B-Bhoxa, T-Tharu; G-Gujjar

Data analysis

Cultural importance (CI) index

The cultural importance (CI) index (Tardio & Pardo-de-Santayana 2008) was used to assess the valuation of magico-religious plants.

$$CI = \sum_{u=1}^{unc} UR_{ui}/N$$

Where 'N' denotes the number of informants and 'UR' is the total number of use reports.

This index is considered valuable in portraying the spread of use (number of participants) and highlighting the diversity of uses for certain plant species (Tardio & Pardo-de-Santayana 2008).

Informant consensus factor (Fic)

Determination of the Informant consensus factor (Fic) was done by the formula suggested by Trotter & Logan (1986)

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

Nur = Number of use reports from informants for a particular use category.

Nt = Number of species employed for that plant use category for all informants.

A high Fic value indicates a reasonable consensus among the informants about using plant species for a particular use category (Heinrich *et al.* 1998).

Results and Discussion

Diversity of the species

The present study revealed 34 plants belonging to 31 genera and 25 families for the magico-religious practices (Table 2). Amaranthaceae, Apocynaceae, Compositae, Euphorbiaceae, Lamiaceae, Moraceae, Nyctaginaceae, Poaceae, and Solanaceae shared two species each (Figure 2) that were utilized in various magico-religious practices like religious ceremonies, protection from evil spirits, and curing of disease. The use of species of these families is also reported in previous studies (Pangging *et al.* 2021; Sharma & Singh 2020).

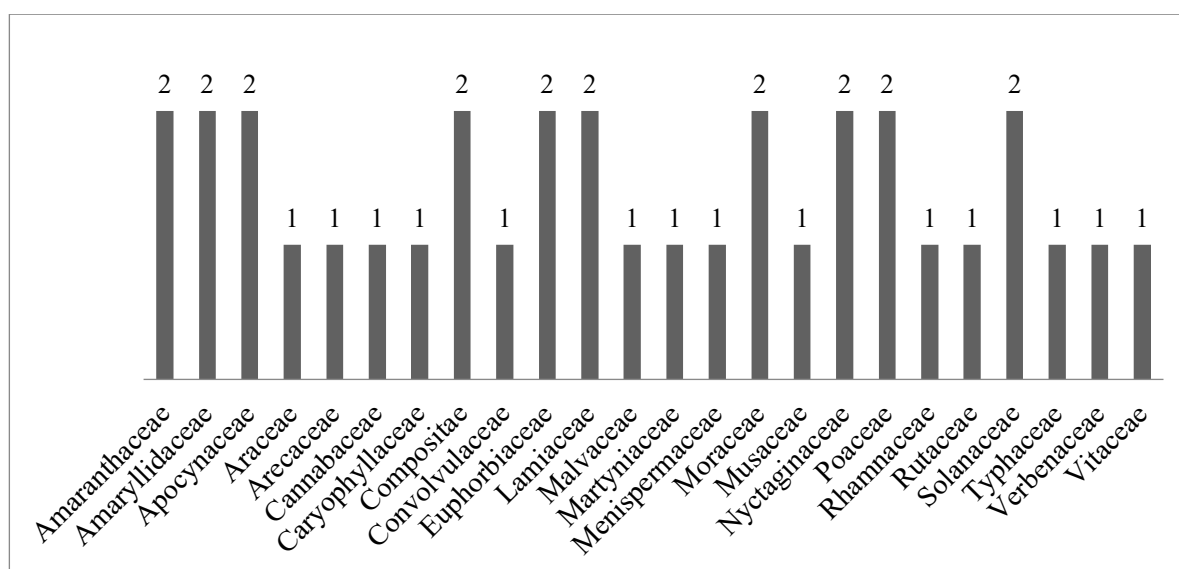


Figure 2. Families used in the socio-magico-religious purposes.

Habit and Habitat

Regarding habit, herbs (59%) were the dominant forms of life used by the indigenous communities, followed by trees, shrubs, and climbers (Figure 3). This pattern is similar to that followed by the Deori tribe in Assam (Pangging

et al. 2019). Herbs and trees (78%) constitute most of the flora used by the Tharu community in Nepal for religious purposes (Sharma 2020). Wastelands (48%) were the dominant source of magico-religious plants, followed by forest (18%), farmland and garden (10% each), agricultural fields (6%), marshy areas (4%), riverbanks, and open pastures (2% each) (Figure 4). Based on magico-religious practices, the plants were categorized into two categories, namely MAG (magical) and SAR (sacred and religious). The results in the Table 3 showed that MAG was the dominant use category with 20 plant species.

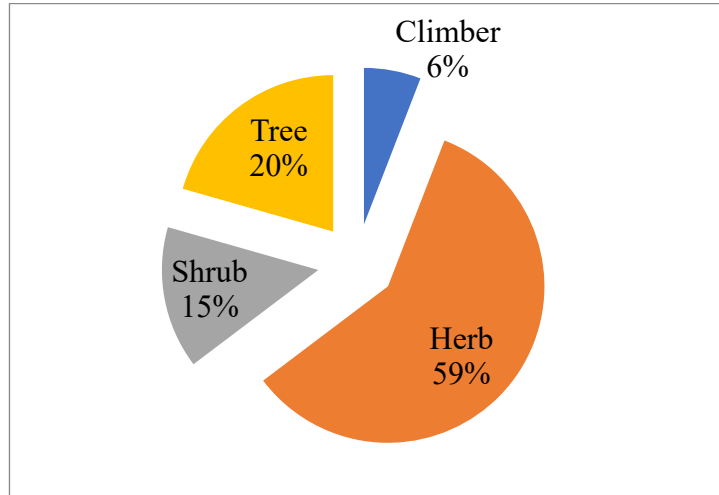


Figure 3. Habit of the plant species used in socio-magico-religious practices in the study area.

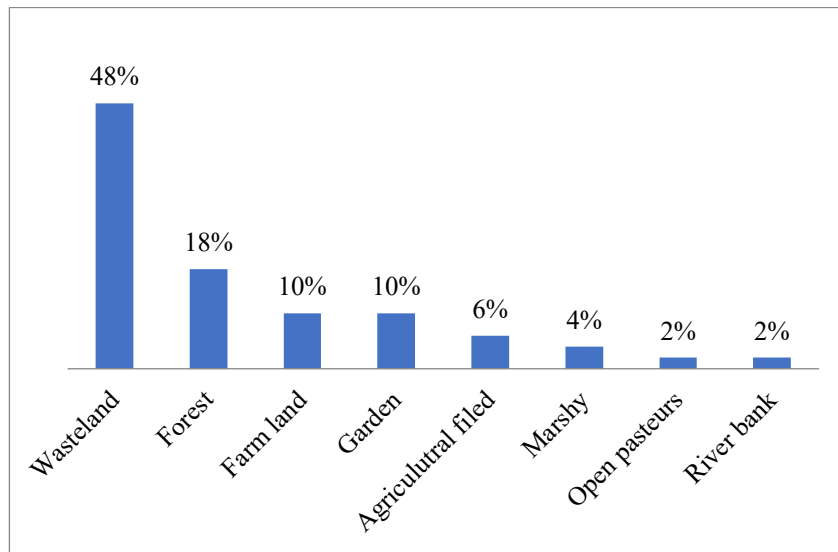


Figure 4. Sources of the socio-magico-religious plants in the study area.

Table 3. Informant consensus factor of two use categories.

Category	Nt	Nur	Fic
MAG	20	566	0.973
SAR	17	752	0.983

MAG=Magical; SAR=Sacred and Religious

Plant parts used

As depicted in Figure 5, the dominant plant parts used in the magico-religious practice of indigenous communities were fruits and whole plant (22% each), followed by leaf (14%), stem, root, and flower (11% each), seed (5%) and bark and bulb (2% each). Fruits and whole plants are mainly used to conduct various social and religious practices, such as offerings in religious ceremonies. In the current investigation, the maximum use of the whole plant for SAR and MAG operations is consistent with the prior findings (Thakur *et al.* 2021).

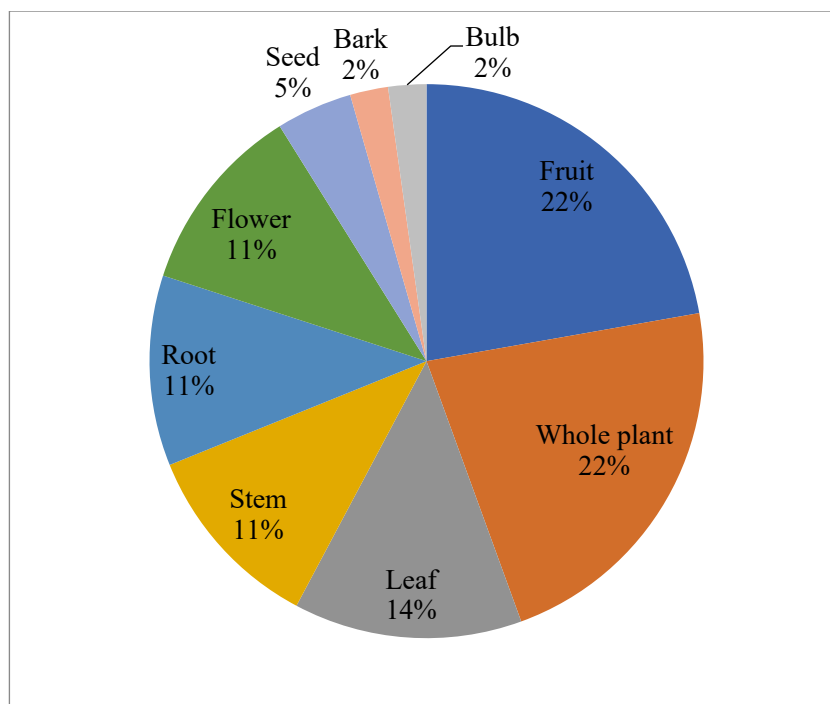


Figure 5. Percentage contribution of the plant parts used in socio-magico-religious practices in the study area.

Informant consensus factor

Among all use categories of magico-religious practices, SAR had the highest informant consensus factor (Fic) value, i.e., in the SAR use category, highest Fic value, i.e., 0.979 and obtained due to the highest use report of plant species viz., *Ocimum tenuiflorum* L. (UR=61), *Ficus religiosa* L. (UR=58), *Cannabis sativa* L. (UR=56), *Ficus benghalensis* L. (UR=54), *Cynodon dactylon* (L.) Pers. (UR=53), *Calotropis procera* (Aiton) Dryand. (UR=48). In the MAG use category, the Fic value was 0.966, and it was due to higher use reports in *Achyranthes aspera* L. (UR=46), *Xanthium strumarium* L. (UR=43), *Boerhavia diffusa* L. (UR=47), *Tinospora sinensis* (Lour.) Merr. (UR=37). Although there is a great deal of variation in traditions and customs among religions, eco-climatic conditions, vegetations, and physiographic regions, the informants have a good understanding of magico-religious plants that is widely shared among the indigenous communities in this region, as evidenced by the high Fic values recorded for MAG and SAR categories in this study. The high Fic for the SAR category has been previously reported (Pangging *et al.* 2021). Several studies in India (Bhatia *et al.* 2014; Singh *et al.* 2021; Khajuria *et al.* 2021) have revealed high Fic values, indicating a high traditional knowledge transfer among informants.

Valuation of magico-religious plants

The Cultural Importance index (CI) value ranged from 0.200 [*Mallotus repandus* (Willd.) Müll. Arg.] to CI=0.918 [*Datura stramonium* L.]. Other plant species with high CI scores were *Aegle marmelos* (L.) Correa, (CI=0.737) *Ocimum tenuiflorum* L., (0.718), *Ficus religiosa* L., (0.682), *Cannabis sativa* L., (CI=0.659) *Ficus benghalensis* L., (CI=0.635) *Cynodon dactylon* (L.) Pers., (CI=0.624), *Calotropis procera* (Aiton) Dryand. (CI=0.565) *Boerhavia diffusa* L. (CI=0.553), *Achyranthes aspera* L. (CI=0.541). The CI index of plant spp. used in magico-religious practices varies within plant families such as *Achyranthes aspera* (CI=0.541) and *Celosia argentea* L. (CI=0.241) in Amaranthaceae, *Calotropis gigantea* (L.) Dryand. (CI=0.506) and *Calotropis procera* (Aiton) Dryand. (CI=0.506) in Apocyanaceae, *Blainvillea acmella* (L.) Philipson (CI=0.318) and *Xanthium strumarium* L. (CI=0.506) in Compositae, *Mallotus philippensis* (Lam.) Müll. Arg. (CI=0.341) and *Mallotus repandus* (Willd.) Müll. Arg. (CI=0.200) in Euphorbiaceae, *Ocimum tenuiflorum* L. (CI=0.718) and *Globba marantina* L. in Lamiaceae (CI=0.329), *Ficus religiosa* L. (CI=0.682) and *Ficus benghalensis* L. (CI=0.635) in Moraceae, *Boerhavia diffusa* L. (CI=0.553) and *Mirabilis jalapa* L. (CI=0.518) in Nyctaginaceae, *Cynodon dactylon* (L.) Pers. (CI=0.624) and *Desmostachya bipinnata* (L.) Stapf (CI=0.541) in Poaceae, *Datura stramonium* L. (CI=0.918), and *Solanum surattense* Burm. f. (CI=0.247) in Solanaceae. Based on use categories, *Ocimum tenuiflorum* L. *Ficus religiosa* L. *Cannabis sativa* L. had the highest score in the CI index in the SAR use category because these species have relatively higher cultural importance. *Boerhavia diffusa* L. had the highest valuation in the MAG use category because many informants reported its uses for curing jaundice in children and adults.

The Himalayan people believe that the unhappiness of local Gods is the cause of all diseases. Their medical system uses magico-religious and natural therapies against diseases (Tiwari 2003). The individuals of different communities in the study area took native medicines. Still, if a person does not recover from an affliction, their relatives approach the mystic priest known as Pujari or Tantrik. If he says the patient is under the anger of the local God or deity, they recommend a magico-religious ceremony known as 'Jagaror Pooja' to appease God. One may witness such a magico-religious ceremony in any village of the Uttarakhand Himalaya, even among the educated classes. All have faith in this system because large numbers of the patients are cured by it (Phondani *et al.* 2011). During the investigation, it was discovered that using the power of traditional knowledge in conjunction with local villagers' regulations may be a practical and feasible way to serve plant conservation and management. In rural areas of India like Garhwal (Uttarakhand), several plants, animals, and even lakes and rivers are considered sacred. Hence, no felling or exploitation is being carried out. As a result of this belief, different species of trees economically important or threatened in other areas are preserved. They can form a genetic reservoir and serve as a guide against the extinction of these species (Anthwal *et al.* 2010).

Comparative assessment with previous studies

The use of *Datura stramonium* in worshipping Lord Shiva people by the Bhoja and Tharu communities (Table 3) is in line with the previous studies from India (Kumar *et al.* 2020) and Nepal (Gaire 2008; Sharma 2020). For centuries, *Datura stramonium* has been utilized for religious and mystic purposes (Gaire and Subedi 2013). The use of *D. stramonium* by the Gujjar community for magical purposes is reported for the first time in India. In Ayurveda, several medicinal uses are attributed to this species, including treating wounds, ulcers, rheumatism, fever, inflammation, asthma, and toothache (Kirtikar & Basu 1999). In Hindu mythology, *Aegel marmelos* have great mythological significance, and the leaves, known as 'Tripatra,' are offered to Lord Shiva (Sharma *et al.* 2007). The sacred and religious use of *Aegel marmelos* by the Bhoja and Tharu communities in the present study is similar to that used by the Tharu and Maithili communities of Eastern Nepal (Chaudhary *et al.* 2020; Mallik *et al.* 2020). The magical use of this species in the current study corroborates with that of the Hajong community of Assam (Sharma *et al.* 2012). However, this magic use contrasts with the use by the Tharu community of Nepal (Chaudhary *et al.* 2020). Each part of *Aegel marmelos* has been used to treat various diseases in Ayurveda and other indigenous healing systems (Sarkar *et al.* 2020). In India, *Ocimum tenuiflorum*, often known as 'Krishna tulsi,' is revered and worshipped in the study area. Similar use has been reported among the Hindu community of Jammu province (Sharma & Singh 2020) Maithili community (Mallik *et al.* 2020), and Tharu community of Eastern Nepal (Chaudhary *et al.* 2020), Nepali community of Sikkim Himalayas and Darjeeling (Chhetri *et al.* 2020). Aside from its religious significance, the flowers, leaves, and stems of *Ocimum tenuiflorum* have long been used in Indian medicine to cure skin ailments, colds, coughs, fevers, vomiting, and swelling (Palla *et al.* 2012). In the current study, the complete plant of *Ficus religiosa* was used for holy and religious purposes, which is similar to what has been reported in Nepal (Mallik *et al.* 2020; Kunwar & Bussmann 2006). In addition to its religious significance, Kumar (2009) noted that locals in Uttarakhand utilize this plant species to ward off demons and evil spirits. Besides, in the Ayurveda and Unani systems of medicine, *Ficus religiosa* is used to treat epilepsy, migraine, vomiting, diabetes, ulcers, constipation, stomatitis, menstrual irregularities, scabies, liver diseases, cough, asthma, chickenpox, leprosy, elephantiasis, gonorrhoea, tuberculosis (Singh *et al.* 2011). Another important medicinal plant in the study area having sacred and religious relevance was *Cannabis sativa*. Hindu devotees in India (Sharma *et al.* 2012; Kuddus *et al.* 2013; Singh *et al.* 2021) and Nepal (Thapa 2015; Shakya *et al.* 2021) offer this plant species to Shiva during religious ceremonies. Besides, this species is highly medicinal because of 'cannabinoids.' These bioactive principles helpful in treating inflammation, colitis, pain, psychiatric illness, sleep, and neurological disorders (Bonini *et al.* 2018).

Cynodon dactylon is considered sacred and religious by the Bhoja and Tharu communities of the study area. However, the Hajong community of Assam uses this species to get rid of evil spirits and remove sins (Sharma *et al.* 2012). This herb is utilized in religious rites by Hindus and is widely used as a traditional medicine in India for dysentery, diarrhea, dropsy, and catarrhal ophthalmia (Jolly and Narayan 2000). The flowers of *Calotropis procera* are presented to Lord Shiva by the Bhoja and Tharu communities. In contrast, the leaves are offered to Lord Hanuman and Lord Shani for blessings in Maharashtra (Pawar 2020). The use of flowers of *Calotropis gigantea* for worshipping in the present study is similar to that reported in Nepal, where it is considered religious and used in child naming ceremonies (*Nwaran*) (Sapkota 2013; Sharma 2020). This Ayurvedic plant also has essential medical characteristics such as antifungal, antipyretic, analgesic, expectorant, anti-inflammatory, and anti-rheumatic (Meena *et al.* 2011). The magical belief that a garland of *Boerhavia diffusa* roots tied on the neck helps treat jaundice is similar to that reported by Vardhana (2018) from Uttar Pradesh. In contrast to this magical use, the flowers and complete plant of *B. diffusa* are utilized in religious rites in Assam (Sharma *et al.* 2012) and Maharashtra (Pawar

2020). In Arabian countries, *B. diffusa* roots and whole plants are utilized in the Ayurvedic and Unani systems of medicine (Nalamolu *et al.* 2004), and many tribal people in India still employ it for the treatment of jaundice and other liver problems (Selvaraj *et al.* 2012). *Desmostachya bipinnata* is a spiritual and religious plant used by the people of Bhoja and Tharu. This plant is considered sacred by the tribal communities of North India (Kandari *et al.* 2014) and is also used in all of Nepal's Brahmin rites (Niroula 2016). The plant species depicts Brahma at the bottom, Vishnu at the middle, and Shiva at the top (Thapa 2015; Sharma 2020). Apart from its religious significance, this plant species is used to treat various ailments in traditional and folklore medicine, and it is an official drug of the Ayurvedic pharmacopeia (Sivarajan & Balachandran 1994). The magical beliefs about using *Achyranthes aspera* in easy delivery and making women pregnant concur with the study conducted in Odisha (Sahu *et al.* 2013). However, in Nepal, people of the Maithili community use it in sacred fires (Mallik *et al.* 2020). According to Ayurveda, *Achyranthes aspera* is useful in treating bronchitis, vomiting, piles, heart disease, abdominal pains, itching, ascites, dysentery, blood diseases, dyspepsia, and also acts as a laxative, carminative, and stomachic (Bhandari, 1990; Dwivedi *et al.* 2007). *Mangifera indica* leaves for religious purposes in the present study have also been previously reported in Uttarakhand (Sharma & Joshi 2010). However, the use report of the present contrasts with a previous study from the neighboring district of Rudrapur, Uttarakhand, where the leaves are used to ward off evil spirits (Kumar 2009). *M. indica* possesses antioxidant, antidiabetic, antiviral, hypotensive, anti-inflammatory, and cardioprotective activities (Shah *et al.* 2010). The use of a rosary made of stem pieces of *Mallotus philippensis* to treat cholera is novel. However, a previous study has mentioned the use of flowers of this species in offerings during Gauri Puja (Lal *et al.* 2014). *M. philippensis* is used by the Tharu, Garo, Kani tribes, and other inhabitants of the Indian subcontinent to treat helminthic infestations, digestive problems, and dermatological disorders (Kumar *et al.* 2020). *Musa balbisiana* is considered a sacred tree, and its leaves are used in religious rituals by the Bhoja and Tharu communities (Table 3). This plant species is also associated with Lord Brihaspati and Vishnu by the people of the Indo Gangetic plains (Pandey & Pandey 2016). People from the Hajong community in Assam, on the other hand, revered the fruits of *M. balbisiana* and hung them with mango leaves at the main entrance of the marriage gate, believing that they would bring peace and wealth to the family (Sharma *et al.* 2012). Besides magico-religious, several medicinal properties have been attributed to this plant, including antimicrobial, antidiabetic, antioxidant, immunomodulatory, anticancer, hypolipidemic, and anti-HIV (Mathew and Negi 2017). The idea that wearing a garland comprised of *Tinospora sinensis* stem pieces will cure jaundice is supported by a previous study from Uttarakhand (Sharma *et al.* 2012). Besides, the Konds (a tribal group of Odisha) wear a necklace composed of stem pieces of *T. sinensis* and believe that it acts as an antidote to snake bites (Sahu *et al.* 2013). In Ayurveda, immune-strengthening properties have been mentioned for this plant species (Singh *et al.* 2003). The magical property of *Vitex negundo* by the Gujjar community in the present study (Table 3) is novel. The root part of *V. negundo* is tied to the arm of a Konds inhabitant, while another piece was tied to the house's roof. They believe it helps in the warding off of ghosts and mitigating planetary effects (Sahu *et al.* 2013). In addition to magico-religious uses, the traditionally claimed medicinal properties such as anti-inflammatory, antihistamine, and analgesic have been pharmacologically validated for this plant species (Dharmasiri *et al.* 2003). The fruits of *Ziziphus jujuba* are offered to Lord Shiva by the people of the Bhoja and Tharu communities. In Himachal Pradesh, fruits of this plant are offered to Lord Shiva on the eve of 'Mahashivratri' (Kumar *et al.* 2020). Thakur *et al.* (2022) reported this religious use in Kullu, Himachal Pradesh; however the study also stated that the fruits are employed in tantric practices. Similarly, the Mising tribe of Assam believes that this plant protects the house and its residents (Pangging *et al.* 2021). *Z. jujuba* is used in the Indian and Chinese traditional systems of medicine to treat several diseases (Mahajan & Chopda 2009; Liu *et al.* 2021).

The percentage similarity of plants being used for magico-religious purposes in several parts of India was below 30 (Table 4) when compared to the present study results. However, both similarities and differences were obtained concerning the usage. In totality, the studied species that were found common in most of the previous studies include *Achyranthes aspera*, *Acorus calamus*, *Aegle marmelos*, *Allium sativum*, *Calotropis gigantea*, *Calotropis procera*, *Cannabis sativa*, *Cynodon dactylon*, *Datura stramonium*, *Desmostachya bipinnata*, *Ficus benghalensis*, *Ficus religiosa*, *Hibiscus rosa sinensis*, *Mallotus philippensis*, *Mangifera indica*, *Mirabilis jalapa*, *Musa balbisiana*, *Ocimum tenuiflorum*. This commonness of species indicates that these species are culturally important throughout India. Therefore, such plants' medicinal and religious potential should be carefully utilized since all of the species listed in this research are economically valuable due to their therapeutic properties. For instance, *Ficus religiosa* (Peepal), *Ocimum tenuiflorum* (Tulsi), and *Aegle marmelos* (Bel) are in high demand throughout the year due to their religious and therapeutic properties. Other researchers have also observed the roles of religious and cultural beliefs in protecting trees (Kandari *et al.* 2014).

Table 4. Similarity of the plants of the present study with previous magico-religious studies from India and neighboring country Nepal.

Study area	No. of the plant reported	No. of plant common to the present study	References
Assam	63	8	Pangging <i>et al.</i> (2021)
Assam	50	2	Sharma & Pegu (2011)
Assam	36	9	Sharma <i>et al.</i> (2012)
Central India	12	8	Sahu <i>et al.</i> (2013)
Himachal Pradesh	43	7	Kumar <i>et al.</i> (2020)
India	11	5	Wani <i>et al.</i> (2020)
India	62	5	Lal <i>et al.</i> (2014)
Indo Gangetic Plains	9	4	Pandey & Pandey (2016)
Jammu and Kashmir	48	2	Thakur <i>et al.</i> (2021)
Jammu and Kashmir	69	12	Sharma & Singh (2020)
Jharkhand	16	1	Singhal <i>et al.</i> (2021)
Kerala	40	4	Pramod <i>et al.</i> (2003)
Maharashtra	27	8	Pawar (2020)
North India	31	7	Kandari <i>et al.</i> (2014)
Tamil Nadu	38	7	Lohidas <i>et al.</i> (2014)
Uttar Pradesh	21	2	Agarwal (2014)
Uttar Pradesh	33	8	Pandey (2019)
Uttarakhand	30	8	Singhal <i>et al.</i> (2017)
Uttarakhand	21	3	Kumar (2009)
Uttarakhand	17	5	Upreti <i>et al.</i> (2017)
Uttarakhand	19	4	Sharma & Joshi (2010)
West Bengal	40	7	Sharma <i>et al.</i> (2014)
Odisha	28	1	Mohanty <i>et al.</i> 2011
Odisha	48	9	Sahu <i>et al.</i> (2013)
Jharkhand	38	8	Kumar & Kumari 2021
Chhattisgarh	36	6	Gupta <i>et al.</i> (2022)
Rupandehi district, western Nepal	32	7	Thapa (2015)
Nepal (Devghat Dham)	50	10	Sharma (2020)
Brahmin and Limbu people of Ilam, Nepal	65	9	Niroula (2016)

In the present study, 44% of the plant species were commonly used by the Bhotia and Tharu communities to perform magico-religious purposes. These include *Achyranthes aspera*, *Mangifera indica*, *Calotropis gigantea*, *Calotropis procera*, *Cannabis sativa*, *Ocimum tenuiflorum*, *Ficus benghalensis*, *Ficus religiosa*, *Musa balbisiana*, *Cynodon dactylon*, *Desmostachya bipinnata*, *Ziziphus jujuba*, *Aegle marmelos*, and *Datura stramonium*. The Gujjar tribe utilized 38% of the species, including *Celosia argentea*, *Acorus calamus*, *Stellaria media*, *Blainvillea acmella*, *Cuscuta reflexa*, *Mallotus philippensis*, *Globba marantina*, *Martynia angulosa*, *Solanum surattense*, *Typha domingensis*, *Vitex negundo*, *Cayratia trifolia*. It is pertinent to mention here that except *Boerhavia diffusa*, all the magico-religious uses mentioned by the Gujjar community have not been found in previous studies. Various religions, supernatural beliefs, and folklores help preserve the destruction of plants (Sharma & Pegu 2011). There are several examples of tree worship traditions in many parts of the world under all religions and beliefs. In the Muslim world and the middle east, sacred plants are close to the veneration of saints (Goldziher 1967; Westermarck 2013). The Tharu community used 9% of the total species, and the species were *Allium sativum*, *Mallotus repandus*, *Mirabilis jalapa*. In contrast, Bhotia and Gujjar communities commonly shared 6% of the total species, including *Boerhavia diffusa* and *Tinospora sinensis*. *Xanthium strumarium* for magico-religious activities is common to both Gujjar and Tharu tribes.

New use reports

After a comprehensive review of the literature, use reports for some species were novel which were *Cayratia trifolia*, *Celosia argentea*, *Cuscuta reflexa*, *Datura stramonium*, *Globba marantina*, *Mallotus repandus*, *Martynia angulosa*, *Phoenix acaulis*, *Solanum surattense*, *Stellaria media*, *Typha domingensis*, *Vitex negundo*, and *Xanthium strumarium*.

Conclusions

The study found that the indigenous communities in the region use 34 plant species from 25 families for various aspects of magico-religious beliefs. It is suggested that the indigenous communities of the sub-Himalayan region be monitored and contacted regularly about their beliefs. They must be informed and made aware of the importance of plant diversity and the significant loss that will occur if it is lost. Furthermore, in the context of global climate change and the increasing reduction of biological diversity due to industrialization, diversified uses of plant resources in magical and religious activities can be a critical step toward their preservation and safeguarding. The magical healing system requires validation through phytochemical, pharmacological studies, and clinical trials.

Declarations

Abbreviations: Habit: H-Herb; S-Shrub; T-Tree; CL-Climber. Source: AF-Agricultural field; F-Forest; FL-Farm land; G-Garden; M-Marshy; OP-Open pastures; RB- Riverbank; W-Wasteland. Plant part used: Fr-Fruit; Wp-Whole plant; Lf-Leaf; St-Stem; Rt-Root; Fl-Flower; Sd-Seed; Ba-Bark; Bu-Bulb. Use category: SAR-Sacred and Religious rite; MAG-Magical belief. Community: B-Bhoxa, T-Tharu; G-Gujjar.

Ethics approval and consent to participate: Prior oral informed consent was taken from all the participants before collecting the information from them.

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