Study on magico-religious plants in Paddari tribe of Jammu and Kashmir, India

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Research

Abstract

Background: The present study was carried out in Paddar region of Jammu and Kashmir to investigate and document the plant species used by the Paddari tribe in socio-magico-religious purposes.

Methods: Ninety-eight informants (55 males and 43 females) in the age of 21 to 80 years were included in the study. Purposive, snowball and random sampling methods were used to choose the informants. Information was collected through semi-structured interviews, observations, group discussions, and field visits. Data was quantitatively analyzed using Relative Frequency of citations (RFCs), Cultural Importance (CI), Family important value (FIV), Informant consensus factor (ICF), Jaccard's Index (JI).

Results: The study documented 32 plants of 31 genera from 19 families for magico-religious purposes. Herbs (47%) were the dominant plant forms and stem (23%) is the mostly used part used in magico-religious practices. *Pyrus malus* L. and *Brassica campestris* L. have high relative frequency of citation (RFC) as well as cultural importance (CI). MAG had the highest informant consensus factor (ICF=0.968). Magico-religious use of *Rosa moschata* Herrm., *Desmodium elegans* DC., *Achillea millefolium* L., *Angelica glauca* Edgew., *Indigofera tinctoria* L., *Prunus persica*, *Rosa webbiana* Wall. ex Royle are reported for the first time.

Conclusions: The people of Paddar have rich traditional knowledge of employing plants in magico-religious practices. It is critical to maintain this traditional knowledge by proper documentation and identification to ensure their sustainable use. It is recommended that the study area's inhabitants must be educated on the value of plant diversity and monitored and contacted on a regular basis regarding their beliefs.

Keywords: Magico-religious beliefs, Sacred Plants, Cultural beliefs, Paddari tribe, Kishtwar, Jammu and Kashmir

Background

Plants are strongly related to and impacted by human culture, ethos, religious ceremonies, stories, myths, folk melodies, and culinary and medical activities (Badoni & Badni 2001). Magico-religious practices are an important aspect of a community's sociocultural and religious characteristics, which eventually flow vertically and horizontally from generation to generation and community to community respectively (Pangging et al. 2021). Religion and traditional belief systems have been acknowledged as being essential in safeguarding of indigenous peoples' natural resources and this has been observed across the world (Bhagwat et al. 2011; Niroula & Singh 2015; Sinthumule & Mashau 2020). Traditional practices and beliefs should be included into conservation efforts since they have the ability to protect biodiversity (Verschuuren et al. 2010; Allendorfs et al. 2014).

In India, tree worship has been practiced from the third and fourth millennia BC. Even the Indus Valley civilization's ceramics depicted palms and peepal trees during the Harappan civilization's emergence (Bhatla et al. 1984). Since ancient times, locals have sought the advice of shamans and tantrics for good health, wealth, and auspicious occasions. For the various sorts of activities, they employ a variety of plants. Tribal cultures maintain their traditions via storytelling and worship their deities from birth to death (Sharma & Pegu 2011). On different important occasions, religious rites or ceremonies are done to seek God's blessing. Various plants and their products that humans utilize daily must be employed in Havan (the burning of herbal ingredients, and other religious events such as Katha, Vrat, festivals, and Pathpuja (Kumar et al. 2007).

In India, 468 sacred and magical plants are divided into 133 families and 340 genera (Sood et al. 2005). For example, *Ficus religiosa* L. and *Aegle marmelos* L. Corr. are worshipped as important emblems of Vishnu and Shiva, respectively, in India (Ramanayya 1985). Traditional herbalists believe that medicinal plants cannot be as effective as they should be unless treated with dignity (Sharma et al. 2012). Indigenous and tribal people use one or more parts of sacred plants in religion and agrarian festivals, as well as in magico-religious beliefs and rituals to worship their traditional Gods and Goddesses, village deities, and to appease supernatural forces for the protection and betterment of human life (Sonowal 2016). In Jammu and Kashmir, sacred plants are utilized in many rituals such as marriage ceremonies, Havans, removing dark magic, prayers, magic, and opening fasts such as in Ramzan, Navratra and Karvachot.

Earlier work in and around the area of study (Kumar 2009; Gupta et al. 2013, Thakur et al. 2020; Dutta et al. 2021; Singh et al. 2022; Batool et al. 2022, 2023; Sharma et al. 2023) is more focused on ethnomedicinal plants, despite the fact that this region is famous for the magico-religious practices. Various research studies documented plants used in magico-religious practices from various parts of India (Pramod et al. 2003; Dinesh 2010; Sharma et al. 2011; Kushwah et al. 2017; Pangging et al. 2021), but no systematic study and evaluation for the various plants used in magico-religious practices in the study area has been carried out. Given this gap, an attempt has been made to investigate and document the plant species utilized in magico-religious practices by the Paddari tribe, which may be lost owing to urbanization and the death of elderly knowledgeable people.

Materials and Methods

Study area

The study was conducted in the Paddar Valley of Jammu and Kashmir (Figure 1). It also known by the name ‘Sapphire Valley’. It lies in the Great Himalayas alongside the Chenab River. The valley borders Ladakh in the north and east, Himachal Pradesh in the south and the rest of Jammu and Kashmir in the west. It includes the northeast part of the District Kishtwar and is located between 33˚15′ 10′′N and 33˚ 30′10′′N and 76˚ 02' 10′′E and 76˚ 25′15′′E having altitudinal range between 1800-5000 m above mean sea level. This valley encompasses 55,152 hectares of area and has a population of 21,548 (http://www.censusindia.gov.). The valley's landscape is diverse, with high mountains, deep valleys, glaciers, streams, and perpetual lakes. Because of the remarkable diversity in topography and climatic circumstances, this region is distinguished by a diverse flora that includes trees, herbs, shrubs, grasses, climbers, lianas, mosses, ferns, and so on. Agricultural fields, temperate broadleaf and deciduous forests occupy the lower altitudes whereas the middle altitudes are covered with coniferous forests and the higher altitudes are occupied by alpine scrub, pastures and snow-covered mountain peaks. The average temperature in summers is between 20˚C and 27˚C. The valley receives considerable snowfall during the winter, and the average temperature drops from -2˚C to -10˚C (Singh et al. 2021).

The tribal people of ancient Paddar were primarily serpent worshipers. However, they observed other Hindu rites and rituals as well. Besides Hindus, Muslims and Buddhists also settled in the valley. All members of the tribal population speak the "Paddari" dialect, which belongs to the Indo-Aryan language family's Western Pahari branch. Hindus perform several ragas

of various deities in temples using "Dhoons," "Nagaras," and flutes. This region is known for its "Kharzath," a dance style that is performed at temples and on events of significance. There are still temples dedicated to several Nagdevtas, or Serpent Gods, and they are embellished with wooden carvings of various kinds of snake. The majority of the population follows Hinduism (83.63%) followed by Buddhism (9.46%) and Islam (6.84%) (http://www.censusindia.gov.).

Data collection

Field visits were conducted in the study area from 2021 to 2023. Ninety-eighty informants (55 males and 43 females) in the age range of 21 to 80 years were interviewed in the study area (Table 1). Purposive, snowball and random sampling methods were used to choose the informants. Priests and Shamans were purposively selected because they were important caretakers of magico-religious knowledge about the plants in the study area. Similarly, information about the plant species was acquired from general informants, which included long-term residents of the tribe as well as ordinary people. Generally, 73 informants were chosen by random sampling technique, while 25 key informants were identified through the purposive and snowball samples. Before interview, prior informed consent (PIC) was taken verbally from all the informants and code of ethics set forth by the International Society of Ethnobiology (2008) was followed. Information verified by two or three sources was the only form we deemed reliable. Information was collected through semi-structured interviews, observations, group discussions, and field visits. The interviews were conducted in 'Paddari' dialect. Data were focused on the magico-religious use of the plant, part used and vernacular names of the plant species. The demographic features of the informants recorded were gender, age group, and education and occupation. Voucher specimens of all the documented plant species were made and deposited in the internationally recognized Janaki Ammal Herbarium (RRLH), Council of Scientific and Industrial Research-Indian Institute of Integrative Medicine (CSIR-IIIM), Jammu for future reference. The Plants were identified using efloras (http://www.efloras.org/), regional floras (Singh & Kachroo 1976; Kachroo et al. 1977) and herbaria RRL and HBJU (Thiers 2023). The botanical name of the plant species were confirmed using http://www.worldfloraonline.org.

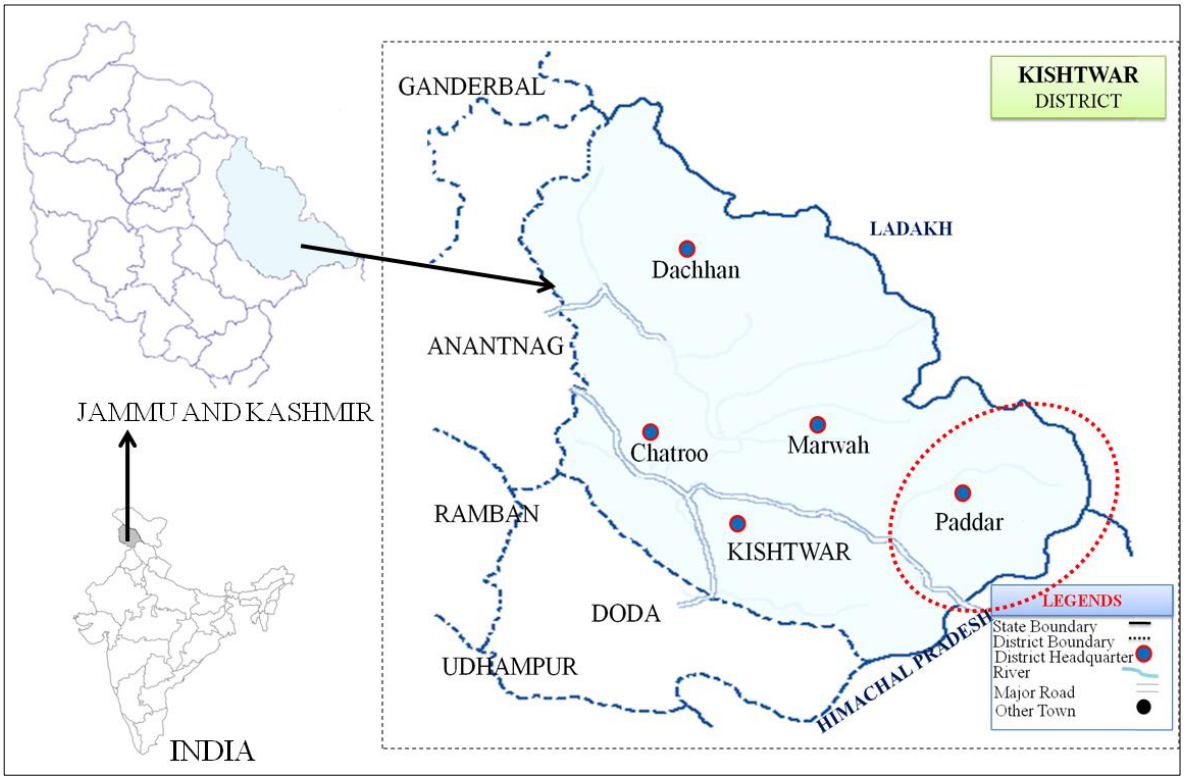

Figure 1. Location of the study area (in circle) in Jammu and Kashmir, India.

Data Analysis

Relative Frequency of citations (RFCs)

RFC indicates the importance of each species and is calculated by dividing the frequency of citation (FC) by total informants (N) without considering the use-categories (Tardio & Pardo-de-Santayana 2008):

$$RFC=FC/N$$

Where 'FC' is the number of informants mentioning the species use and 'N' is the total number of informants involved in the survey (In this study, N=98).

Cultural Importance (CI)

To assess the socio-magico-religious plants, the cultural importance (CI) index (Tardio & Pardo-de-Santayana 2008) was Utilized.

$$\mathrm{CI} = \sum_{u=u1}^{unc} \mathrm{UR\,ui/N}$$

Where 'N' represents the number of informants, and 'UR' represents the total number of use reports. This index helps depict the spread of use (number of participants) and shows the diversity of uses for certain plant species.

Table 1. Description of informants of the present study.

Variable	Category	Number of informants	Key informants
Gender	Male	55	31
	Female	43	5
Age group	21-40 years	40	9
	41-60 years	47	20
	61-80 years	11	7
Education	Illiterate	20	8
	Primary	27	12
	Secondary	30	10
	Higher Secondary	15	4
	Graduates	6	2
Occupation	Priest	10	10
	Shaman	15	15
	General public	73	11

Family important value (FIV)

Family importance value (FIV) depicts the relative importance of families and is evaluated using the methodology of Sreekeesoon and Mahomoodallyn (2014)

$$FIV = FC_{family}/N$$

Where 'FC' is the number of informants stating the family while 'N' is the total number of informants involved in the study (N=98).

Informant consensus factor (ICF)

Informant consensus factor (ICF) is calculated by using formula suggested by Trotter and Logan (1986);

$$ICF=(Nur-Nt)/(Nur-1)$$

Where, Nur = The number of usage reports received from informants for a specific use category.
Nt = Total number of species used in that plant use category by all informants.

A high ICF value shows a reasonable consensus among informants on employing plant species for a specific use category (Heinrich et al. 1998).

Jaccard's Index (JI)

Methodology of González-Tejero et al. (2008) is followed to calculate Jaccard's index (JI). It gives degree of similarity or dissimilarity of magico-religious usage with other neighboring regions.

$$JI=(C\times100)/(a+b-c)$$

Results and Discussion

Diversity of the species

The present study reported 32 plants of 31 genera from 19 families that are used in socio-magico-religious practices by the people of Paddar (Figure 2, Table 2). Among the families that contributed more plant species were Rosaceae represented by 6 species (18.75%), Asteraceae with 4 species (12.5%), Fabaceae and Poaceae with 3 species (9.37%) in each family and Pinaceae with 2 species (6.25%). The remaining families, which were used in various socio-magico-religious acts such as religious ceremonies, and protection from evil spirits, were each represented by a single species. These findings concur with previous studies in Jammu and Kashmir (Sharma & Singh 2020; Thakur et al. 2021), other parts of India (Sharma &

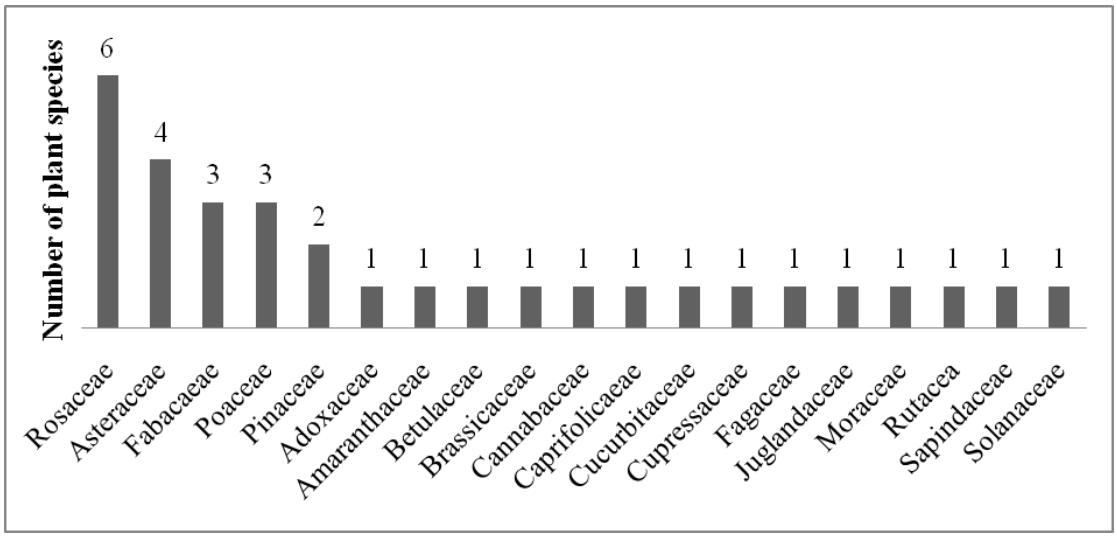

Figure 2. Contribution of the plant families in magico-religious practices by the Paddari tribe.

Pegu 2011; Chhetri et al. 2020; Sheeja & Lohidas 2020; Pangging et al. 2021). However, in contrast to the reports of the present study, Adiantaceae, Amaranthaceae, and Apiaceae, were the most represented families in Kishtwar (Ayub et al. 2013).

Habit and Habitat

In terms of habit, herbs (47%) were the most common forms of life utilized by indigenous communities, followed by trees (28%) and shrubs (25%) (Figure 3). The dominance of herbs in magico-religious practices in the current study is consistent with the previous report from Kishtwar (Ayub et al. 2013), other parts of India (Singhal et al. 2017; Thakur et al. 2022; Sharma et al. 2022) and neighboring country Nepal (Mallik et al. 2020). However, in the Rupandehi District of Western Nepal, the socio-religious flora is represented by equal number of shrubs and trees (Thapa 2015). According to the study, most of the socio-magico-religious plants (22 species; 68.75%) were collected from the wild only 31.25% were cultivated. However, harvesting of plant species direct from wild is not a good indicator as far as sustainable utilization of plants is concerned. As a result, alternate utilization strategies, such as species cultivation are essential. Herb cultivation in the kitchen garden would not only create domestic raw materials but could also assist in the preservation of valuable local plants and traditional wisdom. Another advantage of establishing kitchen gardens for herb cultivation is that rural populations may acquire knowledge about conservation on smaller scales before venturing on to larger areas (Sharma et al. 2023).

Table 2. Documentation of the plants used in magico-religious practices by the local people of Paddar.

Botanical name/ Family/Voucher number (RRLH)	Vernacular name	Habit	Status	Use category	Part used	Threat status	Magico-religious uses	UR	FC	RFC	UC	CI	FIV
Viburnum grandiflorum Wall. ex DC./ Adoxaceae/RRLH-27908	Thilanch	Shrub	Wild	REL	Flower	NE	The flowers of this species are offered to local deities (16).	16	16	0.19	1	0.19	0.19
Chenopodium album L./ Amaranthaceae/RRLH-27909	Kundaa	Herb	Cultivated	REL	Seed	NE	A special gravy locally known as "**Kundaa**" made of seeds of *C. album* with milk is offered in the temples of God Sri Krishna during "Janamashtmi" and is also consumed by the locals during fasting (30).	30	30	0.35	1	0.35	0.35
Achillea millefolium L./ Asteraceae/RRLH-27910	Ghanand	Herb	Wild	MAG	Root	LC	The roots powder is used by the witches (locally called as "**Khichroyee**") to hypnotize people covertly (18).	18	18	0.21	1	0.21	1.14
Jurinea dolomiaea Boiss./ Asteraceae/RRLH-27911	Guggal	Herb	Wild	SAC, REL	Root	NE	Rhizome of this plant is burned frequently by the locals in their houses and is believed to create a calm environment (12). The rhizomes are also burnt during religious festivals (29).	41	34	0.40	2	0.48	
Tagetes erecta L./ Asteraceae/RRLH-27912	Phyur	Herb	Cultivated	REL	Flower	NE	The flowers of this species are frequently offered during religious festivals such as Janamashtami, Shivratri, Diwali (27).	27	27	0.32	1	0.32	
Angelica glauca Edgew./ Asteraceae/RRLH-27913	Chora	Herb	Wild	MAG	Root	EN	The root is kept inside the house and is believed to prevent the entry of snakes in the house (18).	18	18	0.21	1	0.21	
Betula utilis D.Don/ Betulaceae/RRLH-27914	Bhuj	Tree	Wild	REL	Leaf	LC	The leaves are regarded sacred and are used as plates for offering food (locally known as "**Bhoog**") to the deities (21).	21	21	0.25	1	0.25	0.25
Brassica campestris L./ Brassicaceae/RRLH-27915	Shariyon	Herb	Cultivated	MAG, SAC	Seed	NE	The seeds are burnt in fire, and the sick person is supposed to breathe in the smoke to get rid of the evil spirits (22). Seeds are wrapped in piece of cloth and tied on arm or neck to keep evil spirits away (17). Seed oil of this plant is used during "**Tilvayi**", a part of marriage cermony (29).	68	39	0.46	2	0.80	0.46
Cannabis sativa L./ Cannabaceae/RRLH-27916	Bhang	Herb	Wild	REL	Inflorescence, Resin	NE	The young inflorescence and leaves are mixed in wheat flour, fried and eaten after offering to Lord Shiva during "Shivratri," a Hindu festival worshiping God Shiva (25). The mixture of resin from the young inflorescence and milk known locally as "**Ghotta**" is consumed during one-day religious ceremony known as "**Athein**" (16).	41	29	0.34	1	0.48	0.34

Nardostachys jatamansi (D.Don) DC./ Caprifolicaeae/RRLH-27917	Bhootcasi	Herb	Wild	MAG	Root	CR	Rhizome is kept in houses in the notion that it protects the family from ghosts and devils (14). The rhizome is burned inside the house on the assumption that it prevents the entry of snakes (8).	22	14	0.16	1	0.26	0.16
Cucumis sativus L./ Cucurbitaceae/RRLH-27918	Kakid	Herb	Cultivated	REL	Fruit	NE	The fruits are offered to the top tableaus locally known as "**Jhankis**" (Tableau) having photograph of God Krishna during festival known as *Janamashtami* (22).	22	22	0.26	1	0.26	0.26
Juniperus communis L./ Cupressaceae/RRLH-27919	Batheer	Shrub	Wild	SAC, REL	Leaf	LC	Leaves of this plant are burned by the locals in their houses believed to create a calm environment (23) and also used during religious ceremonies (27).	50	37	0.44	2	0.59	0.44
Desmodium elegans DC./ Fabacaeae/RRLH-27920	Kelar	Shrub	Wild	REL	Stem	LC	Young stem of this species is used to make a circular holder in which pieces of wood of *Cedrus deodar* are tightly placed. It is then burned in the night and then thrown away at a specific location during a local religious festival known as '**Shariet**' (25).	25	25	0.29	1	0.29	0.78
Indigofera tinctoria L./ Fabacaeae/RRLH-27921	Shaghal	Shrub	Wild	REL	Stem	NE	The young stem of this plant is wrapped around the top front part of temple to make the local deity satisfied during festival locally known as "**Uzzand**" (16).	16	16	0.19	1	0.19	
Vigna mungo (L.) Hepper/ Fabacaeae/RRLH-27922	Maha daar	Herb	Cultivated	MAG	Seed	NE	The seeds are kept in a glass of water and mantras are recited by the '*Shamans'* to check whether a person is attacked by witches or not (25).	25	25	0.29	1	0.29	
Quercus baloot Griff./ Fagaceae/RRLH-27923	Yir	Tree	Wild	REL	Stem	LC	Wood is used to make pyre in funeral ceremony and branches are used to clean houses before religious ceremonies (9).	19	19	0.22	1	0.22	0.22
Juglans regia L./ Juglandaceae/RRLH-27924	Tharoo	Tree	Wild	REL	Bark	LC	The young stem twigs of this plant are used during during "**Tilwayi**", a part of marriage ceremony (19). The fruits are used in a religious ceremony known as **Katha** or **Hawan** and considered good for health if consumed after the completion of the ceremony (21).	40	26	0.31	2	0.47	0.31
Ficus palmata Forssk./Moraceae/RRLH-27925	Fagood	Tree	Wild	REL	Leaf	NE	Cooked rice is placed on the leaves of this plant and after reciting Mantras offered to the soul of the deceased in a process known as "**Kriya Karam**" (a process followed after ones death) on the 13th day, 6th month and after the completion of 1 year (29).	29	29	0.34	1	0.34	0.34
Cedrus deodara (Roxb. ex D.Don) G.Don/ Pinaceae/RRLH-27926	Dyar	Tree	Wild	REL	Wood	LC	Wood of *C. deodra* is burned in the night during a religious festival known as "Lohri" (23). Wood is also used to construct temples (13).	36	24	0.28	1	0.42	0.56

Pinus wallichiana A.B.Jacks./ Pinaceae/RRLH-27927	Chee	Tree	Wild	REL	Stem	LC	Young stem along with its branches of this plant is used in offering during a religious festival locally known as "**Zagra**" to keep the local deity 'Chandi Mata' happy (24). This festival is celeberted at Gulabgarh (a specific place). The young stem is procured by a designated person known as "**Cheila**". He started his journey from Gulabgarh at 9 pm towards the forest and get back with the young plant at 4 am. It is believed that no person can chase or locate the position of the **"Cheila"** while he is on his duty.	24	24	0.28	1	0.28	
Cynodon dactylon (L.) Pers./ Poaceae/RRLH-27928	Dhlobh	Herb	Wild	SAC	Leaf, Stem	NE	Leaves and stem of this plant are kept in glass of water during solar or lunar eclipse and is considered good for health (19). The stem is also tied to the ring finger of father and mother of a child during marriage ceremony and sacred Yajnopavita (a sacred thread ceremony in which the pupil is brought near the teacher) (13).	32	21	0.25	1	0.38	0.71
Oryza sativa L./ Poaceae/RRLH-27929	Dhaan	Herb	Cultivated	REL	Aerial part	NE	Bundles made of fully ripened rice plant are hanged to the walls of a specific house designated to celebrate the festival known as "**Dharazath**" to persuade the local deity 'Sheshnag' in the month of December (11). Cooked rice is used to perform a special pooja on the 13th day, 6th month and after the completion of 1 year after death of a person). After performing the pooja, rice is drained in water (14).	25	18	0.21	1	0.29	
Zea mays L./ Poaceae/RRLH-27930	Kukid	Herb	Cultivated	MAG, REL	Seed	LC	Chapattis made from the flour is rotated three times over the head of the ailed person alongside mantra recitation to ward against witchcraft attacks (19). The seeds of this plant species are boiled and consumed in the night during a religious festival known as "**Athein**" (16).	35	21	0.25	2	0.41	
Prunus persica (L.) Batsch/ Rosaceae/RRLH-27931	Chanda	Tree	Cultivated	SAC	Stem	NE	The young stem twigs of this plant are used during during "**Tilwayi**", a part of marriage ceremony (12).	12	12	0.14	1	0.14	1.24
Pyrus malus L./ Rosaceae/RRLH-27932	Saib	Tree	Cultivated	REL	Fruit	NE	The fruits are offerd to the temples and consumed during fasting (23). The young stems are used to construct a temporary structure locally known as" **Garzaa**" under which statue of Lord Shiva and his wife Parvati are placed for	52	40	0.47	1	0.61	

							3 days and finally immersed in water in a festival locally known as "**Kanchiyot**" (a festival of Lord Shiv and Parvati marriage) (29).						
Rosa macrophylla Lindl./ Rosaceae/RRLH-27933	Gulaab	Shrub	Wild	REL	Flower	NE	The flowers of this species are offered to local deities (9).	9	9	0.11	1	0.11	
Rosa moschata Herrm./ Rosaceae/RRLH-27934	Kande	Shrub	Wild	REL	Flower	NE	The flowers of this species are offered to local deities (13).	13	13	0.15	1	0.15	
Rosa webbiana Wall. ex Royle/ Rosaceae/RRLH-27935	Gulaab	Shrub	Wild	REL	Flower	NE	The flowers of this species are offered to local deities (5).	5	5	0.06	1	0.06	
Rubus niveus Thunb./ Rosaceae/RRLH-27936	Kande	Shrub	Wild	MAG	Stem	NE	Ring made from the stem of this plant is used to cover the opening of the roof top in the evening. It is thought to prevent the entry of demons in the house. In addition, drawings of witches are made on the roof top with the fine powder made of white stone. The locals believed that the witches visit the roof in the night, dances after watching their pictures and then return back to their places (26).	26	26	0.31	1	0.31	
Skimmia laureola (DC.) Decne./ Rutaceae/RRLH-27937	Shangyal	Herb	Wild	REL	Leaf	NE	Garland of leaves is kept around a newly made house and pooja is performed which is locally known as "**Hawan**" (25). The leaves are tied around the waist by the Chailas (Disciples of God) locally known as "**Drabid**" during locals festivals namely "**Zagra**" and "**Dharadzaath**" (21).	46	32	0.38	1	0.54	0.38
Aesculus indica (Wall. ex Cambess.) Hook./ Sapindaceae/RRLH-27938	Gug	Tree	Wild	MAG	Fruit	LC	Garland made of fruits is used in tantric vidya (13).	13	13	0.15	1	0.15	0.15
Capsicum annum L./ Solanaceae/RRLH-27939	Papee	Herb	Cultivated	MAG	Fruit	NE	The dried fruits are burned while performing a tantric vidya known as "**Kaari**'. The expert locally known as "**Shaagri**" after hypnotizing the ailing person by reciting the Mantras and her/him over the smoke of chilly. Fearing this, "**Kichroye**" (witch) releases the ailing person from his caption. During this entire process, the ailed person does not get any harm however all the damage is faced by the Khichroye (27).	27	27	0.32	1	0.32	0.32

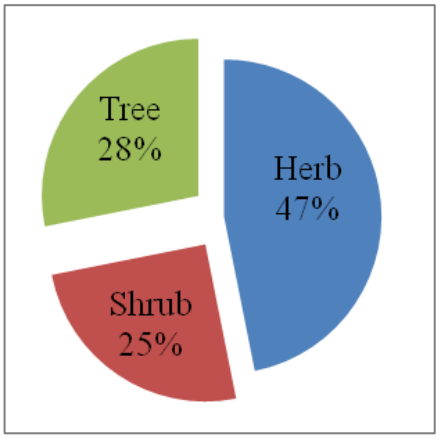

Figure 3. Habit of the plant species used in magico-religious practices by Paddari tribe.

Plant parts used

The most common plant parts employed by the local people in magico-religious practices were stem (23%), leaves, flowers and seed (14% each), fruit (12%), root (11%), whole plant, inflorescence, resin and wood (3% each) (Figure 4). The use of the different plant parts reported in the present study in magico-religious practices correspond to studies conducted previously in India (Chhetri et al. 2020; Thakur et al. 2021) and elsewhere in the world (Thappa 2015; Luximon et al. 2019; Chaudhary et al. 2020). With regard to maximum usage of plant parts in magico-religious practices, flowers were mostly used in Kullu region of Himachal Pradesh (Thakur et al. 2022) and whole plants and fruits in Uttarakhand (Sharma et al. 2022) and leaves in Sikkim Himalaya (Chhetri et al. 2020).

Relative frequency of citation (RFC)

In the current investigation, relative frequency of citation (RFC) ranged from 0.05 to 0.43. *Pyrus malus* L. had highest RFC (43) followed by *Brassica campestris* L. (0.42), *Juniperus communis* L. (0.40), *Jurinea dolomiaea* Boiss. (0.37), *Skimmia laureola* (DC.) Decne. (0.35), *Chenopodium album* L. (0.33), *Cannabis sativa* L and *Ficus palmata* Forssk. (0.32). The high RFC value shows that the inhabitants are well acquainted with the plant species in the study area (Kayani *et al.* 2014).

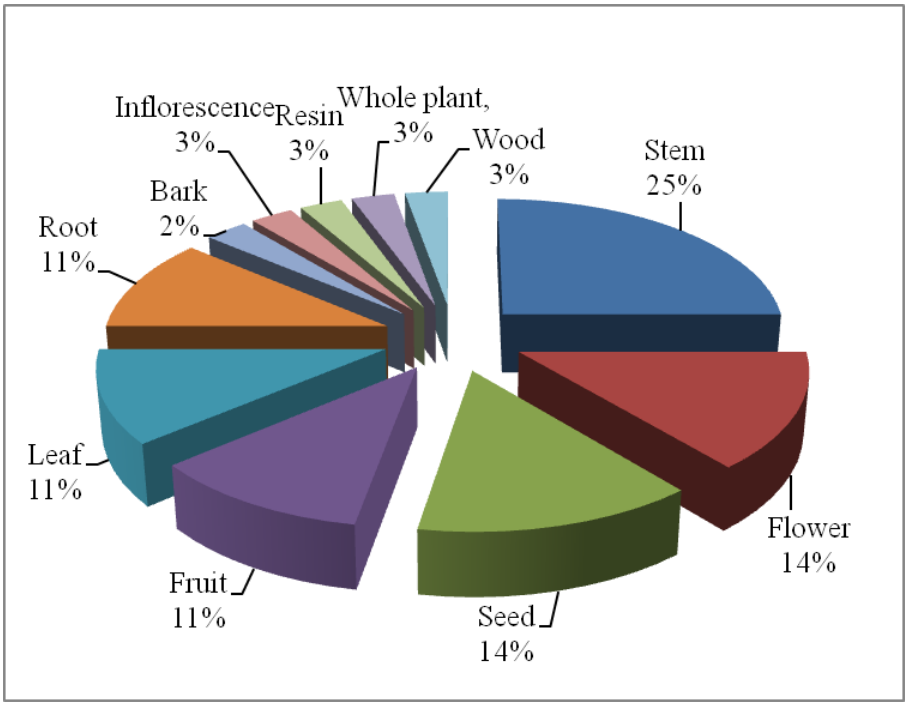

Figure 4. Percentage contribution of the plant parts used in magico-religious practices by Paddari tribe.

Cultural importance index (CI)

B. campestris is the most culturally important plant species (CI=0.80), and it is employed to ward off evil spirits and in religious rites (Table 2). This was followed by *Pyrus malus* (CI=0.61), *Juniperus communis* (CI=0.59), *Skimmia laureola* (CI=0.54), *Jurinea dolomiaea* (CI=0.48), *Cannabis sativa* (CI=0.48), *Juglans regia* (CI=0.47), *Cedrus deodara* (CI=0.42), *Zea mays* (CI=0.41), *Cynodon dactylon* (CI=0.38), *Chenopodium album* (CI=0.35), *Ficus palmata* (CI=0.34), *Tagetes erecta* (CI=0.32), *Capsicum annum* (CI=0.32), *Rubus niveus* (CI=0.31), *Desmodium elegans* DC. (CI=0.29).

Family use value (FIV)

The most common families as depicted by its FIV values were Rosaceae (1.24) Asteraceae (1.14), Fabaceae (0.78), Poaceae (0.71), Pinaceae (0.56), Brassicaceae (0.46), Cupressaceae (0.44), and Rutaceae (0.38). The FIV reflects the number of locally important species belonging to a specific family in the area that is used for the magico religious practices. Plants belonging to these families have also been previously recorded to be used in magico-religious practices in the India (Chhetri *et al.* 2020; Thakur *et al.* 2022; Pangging *et al.* 2021;Sharma *et al.* 2022) and other parts of the world (Sharma *et al.* 2014; Thappa 2015; Niroula 2016; Jigme & Yangchen 2022).

Informant consensus factor (ICF)

The plants were classified into two categories based on magico-religious practices: SAR (sacred and religious) and MAG (magical) (Table 3). Among the use categories, MAG had the highest informant consensus factor (ICF) value of 0.968, while MAG had ICF value of 0.962 (Table 3). These high ICF values indicate that the informants have a good understanding of magico-religious plants that are widely shared among the inhabitants in this region. High ICF values have also been reported previously in Jammu and Kashmir (Thakur *et al.* 2021; Sharma *et al.* 2022) and other parts of the India (Pangging *et al.* 2021).

Table 3. Informant consensus factor (ICF) of two use categories.

Category	Nt	Nu	Nu-Nt	Nu-1	ICF
MAG	9	248	239	247	0.968
SAR	25	634	609	633	0.962

Comparative assessment

B. campestris is used in both magical and sacred and religious activities in the study area (Table 2). However, the Locals in Nepal's Rupandehi district sprinkle the seeds of *B. campestris* around the sacred Mandap during the worship of god, goddess, and Pitrishradha to keep the devil from accessing the Mandap (Thappa 2015). The seeds of *B. campestris* are used

to produce oil, which is believed to be pure for lighting lamps (deepak) and cooking (Kumar 2009). In addition, the Bhutia community of Nepal uses the seeds in death rituals as well (Chhetri *et al.* 2020). Brahmin and Limbu people of Ilam, Nepal use the seeds *B. campestris* in religious practices (Niroula 2016). This plant species has medicinal importance as well. The seed oil of this plant is used by the villagers of Kathua, Jammu and Kashmir to treat snake bite, bloat in cows, and get rid of external parasites (Rao *et al.* 2015). The people in Paddar offer the fruits of *P. malus* to the temples and **Jhanaki**s (tabaleu) especially during **Janamashtami** (a festival in Hinduism to commemorate the birth of Lord Krishna) and in other religious ceremonies (Table 2). In Odhisa, fruits of *P. malus* are used during the Maha Shivratri and Ganesh Pooja for the adoration of Lord Ganeshs and Lord Shiva respectively and consumed as **Prasad** (grace) (Dash *et al.* 2019; Mandal *et al.* 2020). Apart from its religious usage, the tribal women in Kashmir Himalaya use the mixture of fruits of *P. malus*, with honey, unsalted butter, and egg yolk as skin moisturizer and to enhance anti-aging effects (Shaheen *et al.* 2014). The rural communities in Pakistan consume fruit juice of this species to treat body weakness, heart disease, joint problems and hypertension (Ahmad *et al.* 2017; Farooq *et al.* 2019).

The use of *Juniperus communis* reported here is in line with the study carried out in Lahul Valley of Northwest Himalaya (Rawat *et al.* 2012; Haq *et al.* 2022). Additionally, '*Malani'* (ethnic community) in Himachal Pradesh use this plant in oracle rites in getting rid of evil spirits (Sharma *et al.* 2005). *J. communis* has long been used in folk medicine for acute and chronic cystitis, renal suppression, albuminuria, bladder catarrh, amenorrhea, and leucorrhea (Khare 2008). Furthermore, Native Americans employed berries as an anorexigenic agent, female contraceptive, and diabetic therapy (Raina *et al.* 2019). The magico religious use of *S. laureola* reported in the present study is in line with previous studies (Sharma *et al.* 2005; Thakur *et al.* 2021). In addition to religious purposes, the locals of Pakistan's Swat Valley utilize this plant species to ward off evil spirits, produce a pleasant fragrance, and alleviate problems with digestion (Ali *et al.* 2018). In Jammu and Kashmir, the

leaves are used to treat stomach ailments such as dysentery, stomachic discomfort, worm complaints, and nausea (Dutt 2015). In Pakistan, an aqueous preparation of this plant is administered orally to children aged 2 to 10 years to boost their immunity against skin disorders during the summer (Riazuddin *et al.* 1987). Furthermore, leaves are turned into garland and are regarded sacred (Bhalla *et al.* 2021). Besides, *S. laureola* has insecticidal, anthelmintic, antifungal, antioxidant, and antibacterial properties as well (Bhalla *et al.* 2021).

The use of *Jurinea dolomiaea* in SAC and REL is in line with Sharma *et al.* (2005). Besides religious uses, its roots are traditionally used to treat puerperal fever, colic, and as poultice to eruptions while the aromatic oil obtained from the roots is beneficial in gout and rheumatism (Shah *et al.* 2014). *Cannabis sativa* was another medicinal plant in the study area with religious and sacred relevance. During religious festivals, Hindu devotees in India (Sharma *et al.* 2012; Kuddus *et al.* 2013; Singh *et al.* 2021; Sharma *et al.* 2022) and Nepal (Thapa 2015; Shakya *et al.* 2021) offer this plant species to Shiva. Besides, this species is used to treat whooping cough and joint problem (Farooq *et al.* 2019). People in Paddar uses young stem twigs of *J. regia* during during "Tilwayi", a part of marriage and religious ceremony known as Katha or Hawan. In contrast, the fruits of *J. regia* are consumed by Himalayan people for numerous celebratory occasions, including Mala Pournima and Deepawali (Gupta & Sharma 2013). Likewise, people in Uttar Pradesh utilise the bark and nuts of this species as Prasad during the Shivratri festival (Vardhana 2018). Fruits are utilized in rituals in Bhutan, and the trunk is used to make altars (Jigme and Yangchen 2022). *J. regia* fruits combined with *Anacardium occidentale* L., *Vitis vinifera* L., *Prunus dulcis* (Mill.) D.A.Webb, and *Phoenix dactylifera* L. are known locally as 'Panchmewa' and are commonly utilized in religious rites in Rudraprayag, Uttarakhand (Kumar 2009). *J. regia* is well-known for its usage in cardiovascular illness, anti-infectives, Type II diabetes mellitus, antimicrobial, anti-hypertensives, antifungal, and hepatoprotective properties (Gupta *et al.* 2019).

In Hindu Vedic scriptures, *Cedrus deodara* has been described as “Daru” in Kalpasutra and “Bhadra” in Atharva Veda (Singh *et al.* 2014). Its wood is used in construction of temples and also burned in the night during a religious festival known as "Lohri in the study area. In Kullu, Himachal Pradesh, it is considered Devbriksh (Tree of God) and it is believed that Devi Jogani resides in the tree and is planted near temples (Thakur *et al.* 2022). Cedar oil is used to treat pediculosis (Singh *et al.* 2022), inflammation (Khare 2008), insomnia, hiccoughs and dyspepsia (Kirtikar and Basu, 2006). In the present study, *Zea mays* seeds are employed to combat witchcraft attacks and the religious celebration known as "**Athein**" (Table 2). In Bhutan, however, the flour from the grains is used to make the ritual cake (Jigme and Yangchen 2022). Religious communities in Uttar Pradesh considered this the seeds as sacred to Indra and Kama Devta (Vardhana 2018). Phenolic compounds present in *Z. mays* have been shown to have potent antioxidant, anti-inflammatory, antimutagenic, anticarcinogenic, and anti-angiogenesis properties (Lao *et al.* 2017).

In the state of Odisa, the leaves of *C. dactylon* are employed in the worship of Lord Shiva (Mandal *et al.* 2020). While giving blessings ("Dangduwa") to newly married couples in Tripura, the Tripuri tribe utilizes the leaf apex along with cotton and rice grains (*Oryza sativa* Hochst. ex Steud) and *Catharathus roseus* (L.) G. Don. (Sharma *et al.* 2014). This plant is utilized in the Bundelkhand area of India after childbirth to deliver a message to the parent of a married lady (Ahirwar 2013). The plant is blessed by Lord Ganesha, and it is offered during his prayers in order to please him (Sahu *et al.* 2013). Leaves of this species are considered as Abode of Brahma, Vishnu and Mahesh (Vardhana 2018). *C. dactylon* has been reported to possess antibacterial activity (Marasini *et al.* 2015) and antidiabetic properties (Singh *et al.* 2007). Hindu priests in Mauritius believe that Lord Ganesha has blessed this plant and that it is donated to appease him. Furthermore, it is used to apply turmeric to idols and in the Hindu wedding "Haldi" rite (Luximon *et al.* 2019). *Cynodon dactylon* has recently been shown to exhibit antioxidant, anti-inflammatory, and immunomodulatory properties (Singh *et al.* 2021).

The use of *C. album* identified in this study is consistent with a prior study carried out in Doda (Thakur *et al.* 2021). In addition, it has historically been used as a blood cleanser, sedative, hepatoprotective, laxative, antiscorbutic, anthelmintic, and hookworms (Poonia & Upadhayay 2015). It also contains vitamins A and C, vital fatty acids, fibres, proteins, and minerals such as potassium, iron, calcium, and phosphorus (Kumar *et al.* 2017). Besides being used in the scared offerings, the leaves of *F. palmata* are boiled and cooked as a vegetable. It is also believed that who eats this, will have good fortune throughout the year (Thakur *et al.* 2022). *F. palmata* has traditionally been used to treat a variety of ailments including tumors, diabetes, ulcers, gastrointestinal disorders, and fungal infections (Sati *et al.* 2020). *T. erecta,* an aromatic herb is used by the local populace of Paddar in religious offerings. Similar use is reported by Niroula (2016) among the Brahmin and Limbu people of Ilam, Nepal and Tripuri tribe in Tripura (Sharma *et al.* 2014). The flowers *T. erecta* are used as Garland in Lord Ganesh Pooja in Odisha (Dash *et al.* 2019). *Tagetus erecta* extracts have exhibited hepatoprotective, anticancer, antiepileptic, antidiabetic, antidepressant, and antifungal properties (Singh *et al.* 2020).

Local people in Paddar use the dried fruits of *C. annum* to treat an ailed person who is attacked by witches (Table 2). This report is in line with Pangging *et al.* (2021) who reported that the dry fruits are burned to protect a person against unforeseen force. In Assam, Hajong community hung green chili with lemon fruit and a betel leaf around gate of any auspicious ceremony for prosperity and happiness. An important festival named as '**Chili Marriage'** is observed by Hajong to appease the Varun (Water God) to stop heavy shower and flood for protecting their crops from damage is. Two red chilies are symbolically treated as bride and bridegroom (Sharma *et al.* 2012). The use of stem of *R. niveus* in warding off the evil spirit reported in the present study agrees with the previous study of Thakur *et al.* (2021). Besides, roots of *Rubus niveus* are employed in treating dysentery, whooping cough, and have wound healing, and antitumor properties (Farooq *et al.* 2019) The use of *V. mungo* seeds in magic practices in Paddar is also reported from Kullu region of Himachal Pradesh, India (Thakur *et al.* 2022). Besides, the seeds are used as Prasad in Ganesh Puja in Odisha, India (Dash *et al.* 2019). A blend of *V. mungo* and *O. sativa* known locally as '**Khichra**' is offered to Van Devta (forest god) to ward off bad spirits. It is offered to 'Shani Dev' on the day of the Saturday fast (Kumar 2009). According to Kumar *et al.* (2007), 'Khichri /Khichra' has been a symbol of goddess Kali and deity Kalbisht from ancient times.

Oryza sativa seeds are used in sacred and religious practices (Table 2). In Odhisa, people use the plant in worshipping Shiva (Mandal *et al.* 2020) whereas in Nepal, Brahmin and Limbu community use it in other religious practices (Niroula 2016). The Tripuri tribe in Tripura utilizes its grains in combination with "Hoiro" (*Brassica juncea* (L.) Czern.) and "Swtwi" (*Curcuma longa* L.) on the bed to prevent any abrupt shock, and it is also required in funeral ceremonies (Sharma *et al.* 2014). Furthermore, the seeds are used in ceremonies in Bhutan to drive away bad spirits (Jigme & Yangchen 2022). Paddy is revered by the Hadjong community in Assam as the goddess Lakshmi, or the Goddess of Wealth, and its grains are seen as a sign of good fortune and are frequently utilized in all religious festivals (Sharma *et al.* 2012). In Gaziabad, Uttar Pradesh, several religious communities see the seeds grains as a symbol of prosperity and fortune (Vardhana 2018). During Durga Puja in Nepal, the head of the household applies uncooked rice mixed with curd and colors such as red or pink on the foreheads of family members as a blessing (Sharma *et al.* 2014). In Rudraprayad, Uttarakhand, *O. sativa* seeds are given to Brahamins, and it is considered that all crops are a gift from the gods (Kumar 2009). Rice, along with haldi and roli, is used to make a mark on the forehead at numerous social and religious occasions. When the paddy germinates in the shape of tiny green stalk, it is known as '**Kajalia**' and is utilized on the festival of Rakshabandhan (Ahirwar 2013). Fresh grains of *O. sativa* are dedicated to God during '**Udhauli Puja'** every year after harvesting, and entire grains are utilized in numerous socio-religious rites of ethnic communities in the Darjeeling and Sikkim Himalayas (Chhetri *et al.* 2020).

P. wallichiana cones are used in various aspects as it repels negative energy and is hung on outer walls or doors of houses to repel evil spirits. Leaves are used as brooms to drag negativity out (Thakur *et al.* 2022). In Paddar, the rhizome of *N. jatamansi* is utilized to protect the household from ghosts and devils (Table 2). *N. jatamansi* is utilized in Kumaon in magico-religious ceremonies known as 'Jagar,' in which Gods and local deities are aroused from their slumber and asked for blessings or remedies (Shah 2023). It is used in religious rites by Ethnic communities in the Darjeeling and Sikkim Himalayas as an ingredient in 'Hawan' (Chhetri *et al.* 2020). *N. jatamansi* is a critically endangered medicinal plant that grows at high altitudes in the Himalayan alpine and subalpine areas. Its therapeutic value is acknowledged in Bhutanese, Chinese, Indian, Japanese, Nepalese, and Tibetan medicine (Kaur *et al.* 2020). *Cucumis sativus* fruits are use during Nagpanchmi Pooja in Gaziabad, India (Vardhana 2018). The holy stem bark of *B. utitlis* is used as plates in religious rites for presenting food in the study area. In the Western Himalaya, *B. utilis* has spiritual significance (Haq *et al.* 2022). Tantriks utilize the bark of this tree to make talishman and amulets (Sood *et al.* 2005). The stem and bark are used in Havan Kunds and Pooja Samagries in Gaziabad, Uttar Pradesh (Vardhana 2018).

The religious use of *Q. baloot* reported in the present study is similar to that reported by Thakur *et al.* (2021). The use of *V. grandiflorum* in religious offering in Paddar is similar to that reported by Thakur *et al.* (2021) from Doda, Jammu and Kashmir. Garland made of fruits of *A. indica* is used in tantric vidya in Paddar. However, in Uttarakhand, its wood is regarded sacred and is used to make palanquins (Devta Doli) for the local deity (Sood *et al.* 2005). In Kullu, Himachal Pradesh, its flowers are utilized by the villagers in several forms of 'Poojas' and fruits in treating treat cramps during menstruation (Thakur *et al.* 2022). Rural people in Pakistan use the bark, fruits and seeds to treat fever, indigestion and gout respectively (Farooq *et al.* 2019). Flowers of *R. macrophylla* are offered in temples by the local people in Paddar. Similar use is reported from Uttara Pradesh (Vardhana 2018). It is also used as fuelwood in Nepal (Bhattarai *et al.* 2010), and its fruits are used as as an eye tonic by the Bhotia, Managis, Sherpa communities in Nepal (Gewali & Awale 2008).

Jaccard's index

Jaccard's Index was utilized to assess similarities in the utilization of flora in the present investigation, other regions of India, and the neighboring countries (Table 4). The plant species included in the current study were compared to 27 prior magico-

religious studies published. JI values varied from 0% to 27.0%, with an average of 7.1%%. District Doda of Jammu and Kashmir had the highest degree of similarity, with a JI of 27.0 (Thakur *et al.* 2021), followed by Himachal Pradesh, with a JI of 15.1 (Thakur *et al.* 2022). *C. dactylon, T. erecta*, *B. campestris*, and *O. sativa* were the most common species when compared to previous studies. This commonness of species indicates that these species are culturally important throughout India. Therefore, such plants' with medicinal and religious potential should be carefully utilized. The plant species used in magico-religious practices in West Bengal, India Indo Gangetic Plains, India, Odisha were entirely different from the present study (JI=0). This least value of JI reflects that areas do not share common cultural values and have geo-topographic differences. Furthermore, the origin and culture of indigenous populations have a strong effect on magico-religious knowledge. The role of traditional belief systems and religion in the safeguarding of natural resources of indigenous communities has been acknowledged across the world (Sharma & Pegu 2011; Niroula & Singh 2015; Sinthumule & Mashau 2020; Abdullah 2022).

Table 4. Jaccard's index comparison of species of the present study with previous magico-religious studies.

Study area/Country	**Total documented species**	**Species in the present study**	**Species common to both areas**	**Jaccard's index (JI)**	**References**
Assam, India	63	32	1	1.1	Pangging *et al.* (2021)
Assam, India	50	32	1	1.2	Sharma & Pegu (2011)
Birbhum district, West Bengal, India	17	32	0	0	Ghosh *et al.* (2012)
Darjeeling and Sikkim Himalayas, India	74	32	8	8.2	Chhetri *et al.* (2020)
Himachal Pradesh, India	43	32	5	7.1	Kumar *et al.* (2020)
Kullu, Himachal Pradesh, India	75	32	14	15.1	Thakur *et al.* (2022)
India, India	62	32	1	1.1	Lal *et al.* (2014
Indo Gangetic Plains, India	9	32	0	0.0	Pandey & Pandey (2016)
Doda, Jammu and Kashmir, India	48	32	17	27.0	Thakur *et al.* (2021)
Kanyakumari District, Tamil Nadu, India	38	32	2		Lohidas *et al.* (2014)
Kathua, India	25	32	5	9.6	Bhushan & Khajuria (2018)
Kerala, India	40	32	1	1.4	Pramod *et al.* (2003)
Kishtwar, India	16	32	6	14.3	Ayub *et al* .(2013)
Nashik District, Maharashtra	27	32	2	3.5	Pawar (2020)
North India, India	31	32	4	6.8	Kandari *et al.* (2014)
Odisha, India	28	32	0	0.0	Mohanty *et al.* 2011
Shivaliks to Greater Himalaya in Jammu, India	69	32	12	13.5	Sharma & Singh (2020)
Tripura, India	59	32	3	3.4	Sharma *et al.* (2014)
Uttar Pradesh, India	33	32	4	6.6	Pandey (2019)
Uttarakhand, India	30	32	5	8.8	Singhal *et al.* (2017)
Uttarakhand, India	21	32	6	12.8	Kumar (2009)
Uttarakhand, India	34	32	2	3.1	Sharma *et al.* (2022)
Dooars Region, West Bengal, India	40	32	4	5.9	Sharma *et al.* (2014)
Brahmin and Limbu people of Ilam, Nepal	65	32	8	9.0	Niroula (2016)
Devghat Dham, Nepal	50	32	5	6.5	Sharma (2020)
Rupandehi District, Western Nepal	32	32	6	10.0	Thappa (2015)
Kanglung Gewog, Trashigang District, Bhutan	24	32	4	0.0	Jigme & Yangchen (2022)

Novelty of the study

Comprehensive literature review revealed the use of *Rosa moschata, D. elegans, Achillea millefolium* L., *Angelica glauca Edgew., Indigofera tinctoria* L., *Prunus persica* (L.) Batsch, *Rosa webbiana* Wall. Ex Royle in magico-religious practices for the first time. According to the IUCN Red List Categories and Criteria (https://www.iucnredlist.org), *Nardostachys jatamansi* and *A. glauca* was Critically Endangered and Endangered respectively whereas and 31.2% (10 species) of the plant species reported in this study were Least Concern. The IUCN threat status of the remaining plant species was not evaluated.

Conclusion

The study reported that 32 plant species from 19 families are used by people of Paddar for different aspects of magico-religious beliefs. This research also assisted us in revealing the hidden and covert applications of the flora of this region, particularly for tantric and shaman practices, as well as plants utilized in many sacred rites and ceremonies. It is recommended that the individuals in the research region should be monitored and involved in regular discussions regarding their beliefs. They must be made aware of the importance of plant diversity and the devastating consequences of its extinction. Furthermore, in light of climate change as well as the increasing loss of biological diversity as a result of industrialization, different uses of plant resources in magical and religious rituals can be a significant step towards their preservation and conservation.

Declarations

Abbreviations: SAC-Sacred; MAG-Magical; REL-Religious. Threat category: CR-Critically endangered; LC=Least Concern; NE-Not evaluated

Ethics Approval: Verbal prior informal information consent was obtained before the survey.

Consent for publication: People shown in images gave their prior informed consent for the publication of the image.

Availability of Data Materials: All the supporting data available in article.

Competing Interest: Authors should declare no competing or conflict of interest.

Funding: Not applicable.

Authors Contribution: KS and SG designed the study. KS collected the data, analyzed the results and wrote the manuscript; PK, BK and SG restructured and revised the manuscript.

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