Traditional knowledge of sacred and ritual plants among local communities of Sivasagar, Assam

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Research

Abstract

Background: The present study documents magico-religious plants used by the people of Sivasagar district in Assam. The region harbors a rich biocultural heritage, in which local people have incorporated several plant species into their rituals, festivals, and beliefs. However, this important traditional knowledge is gradually fading due to modernization, cultural transformation, migration, and the weakening of oral transmission. Therefore, it is imperative to document such important information before it gets lost.

Methods: Ethnobotanical surveys were conducted in various villages of Sivasagar District, Assam, from December 2025 to June 2026. Semi-structured interviews and group discussions were used to collect data from 102 informants. Data on plant species, plant parts used, habitats, and associated magico-religious practices were recorded. Quantitative analyses used were Cultural Importance Index (CI), Cultural Value Index (CV), Frequency of Citation (FC), Relative Frequency of Citation (RFC), and Informant Consensus Factor (ICF).

Results: Overall, 75 plants were identified, belonging to 66 genera and 40 families. Moraceae was the predominant family (six species), followed by Fabaceae and Lamiaceae (five species each). Herbs were the dominant life form (48%) and home gardens the dominant source of ritual plants (50.67%). The most reported reasons for use were sacred and religious (58.56%), followed by magical beliefs (28.67%) and social ceremonies (12.77%). The ICF values ranged from 0.974 to 0.982, indicating strong agreement among the informants. *Mangifera indica* L. (UR = 80, RFC = 0.784) shows the highest CI Index (0.79) and CV Index (0.415). *Mangifera indica* L. and *Wallaceodoxa raja-ampat* Heatubun & W.J.Baker had the highest FC (80).

Conclusions: The communities of the Sivasagar district depend extensively on plant-based magico- religious traditions to maintain their cultural and spiritual practices despite increasing socio-cultural changes. Therefore, efforts should be made to educate the local communities about risk factors confronting biodiversity and train them in advanced sustainable conservation methods to ensure the longevity of the plant resources.

Keywords: Ethnobotany; Sacred plants; Religious plants; Indigenous knowledge; Assam; Northeast India

Background

Plants have been an essential part of human cultures since ancient times, as a source of food, medicine, shelter, and the means of daily life (Sahoo *et al.* 2021). They are also important religious, spiritual, and cultural elements of people around the world, in addition to their practical use. Ethnobotany, the study of human-plant interactions, has increasingly recognized the importance of documenting traditional ecological knowledge to preserve cultural heritage and support biodiversity conservation. Among the various aspects of ethnobotanical knowledge, one distinctive point of intersection among culture, systems of belief, and environmental care is the utilization of plants in magico-religious acts. Magico-religious plants are connected to sacred rituals, worship, festivals, supernatural beliefs, protection against evil spirits, healing ceremonies, taboos, and other cultural practices. Such beliefs often influence the selection, preservation, and utilization of plant species in traditional societies (Rawat & Kumar 2024). Some plants are considered sacred by many indigenous and rural communities because they believe these plants possess divine powers or are the abodes of deities and ancestral spirits. Thus, these plants are spared from destruction and continue to play important roles in social and religious life.

Plants hold sacred significance across India's diverse religious traditions, where associated beliefs and rituals have historically contributed to their cultivation, protection, and conservation. India has a long tradition of plant worship and sacred ecology going back thousands of years. Plant species like *Ocimum tenuiflorum* L., *Ficus religiosa* L., *Aegle marmelos* (L.) Corrêa, and *Cynodon dactylon* (L.) Pers. are associated with various religious customs, rituals, and festivals. These traditions have made an important contribution to biodiversity conservation by protecting sacred groves, temple gardens, and culturally important species. Recent ethnobotanical studies from different parts of India have emphasized the need to document magico-religious plant knowledge, lest it vanish amid the march of modernization, urbanization, and changing socio-cultural values. Among the diverse ethnic communities of India, plants play a crucial role in cultural practices and rituals marking different stages of life. In addition to their ritual significance, plants revered as sacred to gods and goddesses are often considered to possess medicinal and healing properties (Akhilraj *et al.* 2021).

Northeast India constitutes one of the world's biodiversity hotspots and is also home to various ethnic communities with extensive traditional knowledge of biological resources. In this biodiversity hotspot, Assam has a high degree of cultural diversity, with plants playing an integral role in medicine, religious ceremonies, folk beliefs, festivals, and customs. Several studies have periodically explored the medicinal potential of Assam's flora (Sharma *et al.* 2012; Baidya *et al.* 2020; Bhattacharjya *et al.* 2023; Begum *et al.* 2024; Kalita *et al.* 2025). Previous studies have documented the strong relationship between local communities and the surrounding vegetation in Assam, highlighting the use of plants in supernatural beliefs, ritual offerings, and sacred ceremonies across Assam's ethnic groups (Sharma *et al.* 2011; Sharma *et al.* 2012; Brahma *et al.* 2015; Pangging *et al.* 2019; Pangging *et al.* 2021; Borah *et al.* 2025).

Sivasagar District, the cultural heartland of the Ahom Kingdom, is a rich blend of indigenous traditions, religious practices, and folk beliefs. The district is characterized by a rich cultural heritage in which plants continue to play an important role in rituals, festivals, ancestor worship, household ceremonies, and traditional healing practices. Despite its cultural significance, magico-religious plants in Sivasagar District remain under-documented and lack quantitative assessment. Socio-economic changes, migration, and modernization have rapidly eroded this traditional knowledge, further emphasizing the need to document this rich ethnobotanical heritage. Therefore, this study was conducted to collect information on plant species associated with magico-religious practices in the Sivasagar District of Upper Assam and to assess their cultural significance using ethnobotanical indices quantitatively. The hope is that the study will help preserve traditional knowledge, increase understanding of the link between culture and biodiversity, and provide baseline information for future ethnobotanical investigations and conservation initiatives in the region.

Materials and Methods

Study area

The present ethnobotanical study was done in the Sivasagar District of the north-eastern province of Assam (Fig. 1). The district covers an area of around 2668 sq. km and lies between 26.45°–27.15°N and 94.25°–95.25°E. Charaideo District flanks it to the east, Dibrugarh District to the north-east, Jorhat District to the west, the Brahmaputra River forms the northern boundary, and Nagaland lies to the south. The district has a tropical, humid climate with high relative humidity (60-95%) and annual rainfall of 230-450 cm, of which almost 64% falls during the monsoon season. The Sivasagar Forest Division comprises approximately 24,048 ha of forest land, including 10,529 ha of dense forest and 13,519 ha of open forest. The region harbors diverse vegetation types across forests, riverbanks, roadsides, and home gardens, providing a rich repository of plant

resources for local communities. The district's heterogeneous vegetation and diverse habitat types significantly contribute to the availability and utilization of plant resources in traditional healthcare, food systems, and cultural practices.

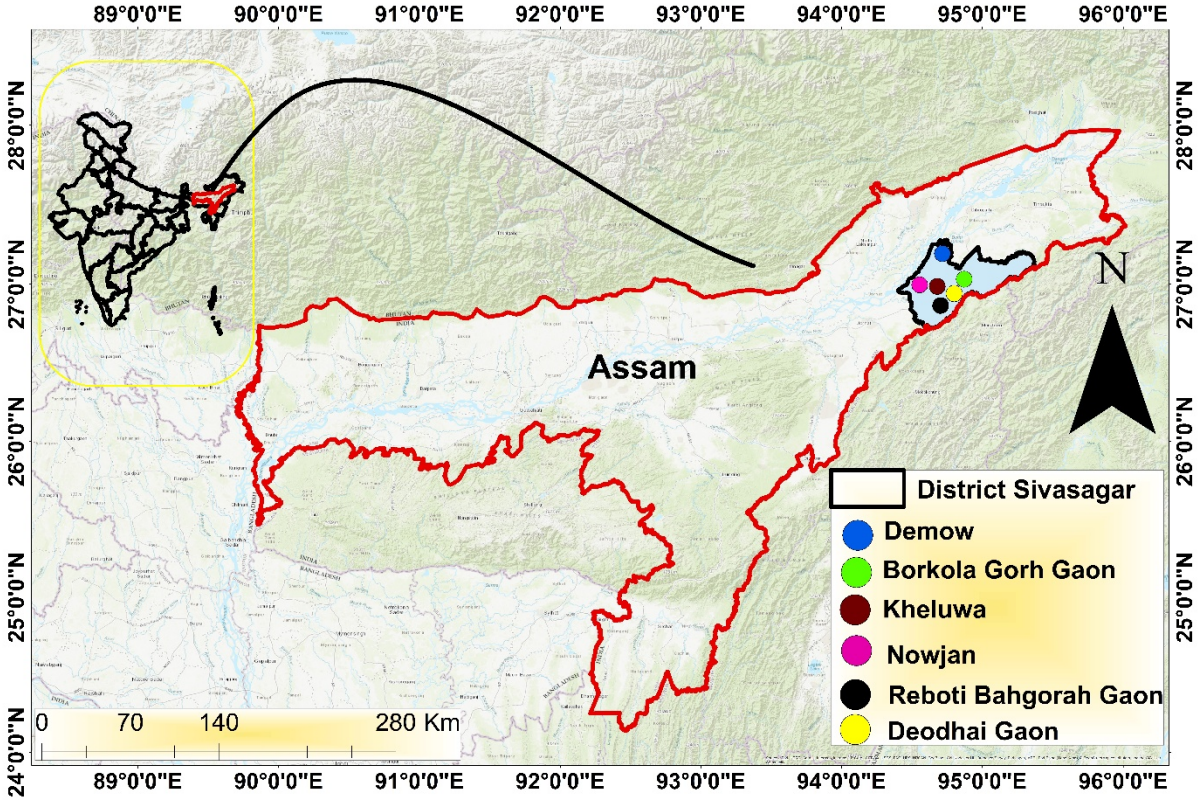

Figure 1. Map showing the study sites in Sivasagar district, Assam

Data Collection

Field surveys were conducted in Sivasagar District, Assam, from December 2025 to June 2026. Before data collection, verbal informed consent was obtained from each participant, and all research activities were conducted in accordance with the ethical guidelines (ISE 2006). A total of 102 informants (36 males and 66 females) aged 25 to over 80 years were interviewed (Table 1). Informants were selected through purposive sampling using the snowball technique with particular emphasis on knowledgeable individuals such as priests and traditional healers who actively practice magico-religious plant traditions. The informants were categorized into three age groups: 25-35, 35-50, and 50-80. Notably, most informants were over 50, indicating that the older generation predominantly retains traditional ethnobotanical knowledge.

Table 1. Details of informants in the present study.

	No. of informants	Percentage of informants (%)
Gender		
Male	36	35.29%
Female	66	64.70%
Educational level		
Illiterate (never attended school)	30	29.41%
Primary level (from 1 to 4 years)	9	8.82%
Middle level (from 5 to 7 years)	38	37.25%
Secondary level (from 8 to 12 years)	19	18.62%
Graduate (Above 12 years)	6	5.88%
Age group		
25–35 yrs (Avg. = 31.80 yrs)	16	15.68%
35–50 yrs (Avg. = 42.50 yrs)	63	61.76%
50–80 yrs (Avg. = 56.18 yrs)	23	22.54%

The educational qualifications of the informants were also recorded. It was found that most had no formal education (29.41%), followed by middle education (i.e., classes 5th to 7th, 29.41%), secondary education (i.e., classes 8th to 12th, 18.63%), primary education (i.e., classes 1 to 4th, 8.82%), and graduate (5.88%). Older individuals with no formal education or only primary-level education are more likely to hold sacred and magico-religious beliefs associated with plants, which are more prevalent among certain demographic groups, suggesting a relationship between age, educational qualification, and the prominence of these beliefs (Rawat and Kumar 2024). Semi-structured interviews and group discussions were conducted to collect data. Data recorded included plant habits, plant parts used, vernacular names, and associated magico-religious beliefs and rituals. During the survey, information was considered reliable only if independently corroborated by two or more informants, and photographs of all documented plant specimens were taken. Voucher specimens of all collected plant species were processed, dried, and deposited in the herbarium of the CSIR-NEIST, Jorhat, Assam, India (Table 2). Plant identification was conducted using regional floras, including the Flora of Assam (Bora 2003; Kanjilal *et al.* 2015), the Flora of British India (Hooker 1885), and digital databases (www.efloras.org; https://efloraofindia.com; https://indiabiodiversity.org). The accepted scientific names and current IUCN status of all species were verified using World Flora Online (https://www.worldfloraonline.org) and the IUCN Red List of Threatened Species (https://www.iucnredlist.org/), respectively.

Data Analysis

The data obtained from the field survey were classified into three categories: Sacred (SAR), Magic beliefs (MAG), and Social ceremonies (SC). Ethnobotanical data were entered and analyzed using Microsoft Excel 2021 and OriginPro 2024 (OriginLab Corporation, Northampton, MA, USA). Quantitative ethnobotanical indices, namely Frequency of Citation, Relative Frequency of Citation, Use Reports, Number of Uses, Cultural Importance Index, Cultural Value Index, and Informant Consensus Factor, were calculated to evaluate the cultural significance and utilization patterns of magico-religious plant species.

Frequency of citation (FC)

FC refers to the number of informants who mention or cite a particular plant species, regardless of how many different uses they report for that species.

FC = Number of informants who cited a species.

Relative Frequency of Citation (RFC)

It is used to measure the traditional importance or popularity of a plant species within a community. It indicates the proportion of respondents who mentioned a particular plant during the survey. The following formula, as suggested by (Tardío and Pardo-de-Santayana, 2008), calculates it-

$$RFC = \frac{FC}{\mathrm{N}}$$

Where FC is the number of informants who cited the use of a particular plant, and N is the total number of informants in the study (n=102 in the present study).

Cultural Importance Index (CI)

To calculate the cultural significance of each species, the cultural importance index (CI) was computed as the sum of the usage reports (UR) across all use categories for a species divided by the number of participants (N) (Tardio and Pardo- De-Santayana, 2008).

$$CI = \sum_{i=1}^{i=NU} UR\, i/N$$

Cultural Value Index (CV)

It combines information on the diversity of uses, frequency of citation, and cultural importance of a plant species Reyes-García *et al.* 2006)

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

The theoretical highest value would be realized if components were at their highest; under the improbable circumstance that every informant indicated the species' use (FCs=N) in all evaluated categories of the survey (NUs=NC). The first two

variables will amount to one, while the third variable will denote the overall number of possible use categories (NC). Thus, this index varies from zero to NC (no. of use categories).

Informant Consensus Factor (ICF)

ICF was used to assess the degree of agreement among informants regarding the use of species for a particular category. The ICF was calculated using the formula:

$$ICF = \frac{N_{ur} - N_t}{N_{ur} - 1}$$

where *Nur* is the total no. of use reports recorded for a particular use category, and N_t is the number of plant taxa used within that category. Higher ICF values show the popularity of the particular usage of plants for a specific condition due to the general agreement of the people on its use.

Hierarchical cluster analysis (HCA)

Hierarchical Cluster Analysis (HCA) was carried out with Ward's linkage method and Euclidean distance to observe the similarities among the plant species in terms of the ethnobotanical indices used. HCA allows individual species with similar combinations of cultural importance, citation frequency, and ritual-use characteristics to be grouped together. The resulting dendrogram was used to identify clusters of species with similar degrees of cultural significance and patterns of ritual use.

Jaccard's Index

To make the comparison of the present study with the previous studies on magico-religious plants from different regions of India, the Jaccard Similarity Index (JI) was calculated by using the formula:

$$JI = \left(\frac{c}{a + b - c}\right) X\ 100$$

Where 'a' is the number of species documented in the present study, 'b'' denotes the number of species reported in the reference study, and 'c' is the number of species shared by both studies.

Results and Discussion

Diversity of plant species

The present study has found that the people of Sivasagar district use 75 plant species, grouped into 66 genera and 40 families, for socio-magico-religious purposes (Table 2). The families that contributed more plant species were Moraceae with six species (8%), Fabaceae and Lamiaceae with five species (7%), Poaceae with four species (5.33%), and Apocynaceae, Euphorbiaceae, Lygodiaceae, Menispermaceae, Piperaceae and Rutaceae with three species (4%); Apiaceae, Arecaceae, Cucurbitaceae, Lauraceae, Phyllanthaceae and Solanaceae with two species (3%). The remaining families had only one species each and were used for a variety of socio-magico-religious activities, such as religious rites and evil eye protection. The dominant use of Moraceae, Fabaceae, and Lamiaceae may be linked to the cultural selection of the plants belonging to these families. For example, *Ocimum tenuiflorum* and *Flemingia strobilifera* are a vital part of their local festivals like ***Bihu***. Plant species such as *Clerodendrum glandulosum* and *Clerodendrum infortunatum*, *Ohwia caudata*, and *Streblus asper* act as key sacred components and are used in traditional brewing for ritual offerings (Table 2). It was observed in the study that the local communities conserve and cultivate these species because of the deep-rootedness of these plants in their regional heritage. The predominance of these families has also been reported in several earlier studies from the Northern Himalayan region (Prasad Sapkota 2013; Pangging *et al.* 2019; Batool *et al.* 2022; Batool *et al.* 2023; Sharma *et al.* 2022; Sharma *et al.* 2023; Rawat & Kumar 2024; Singh *et al.* 2024a; Borah *et al.* 2025).

Habit and habitat

Herbs (48%) were the most commonly used plant forms by local populations, followed by trees, shrubs, and climbers. This is similar to some previous studies (Panging *et al.* 2019, Sharma *et al.* 2022). This dominance of herbaceous species in the magico-religious ethnoflora of Sivasagar broadly parallels earlier reports from northeast India and the wider Himalayan foothills, where herbs consistently constitute the largest life-form class in ritual inventories (Rawat & Kumar 2024; Thakur *et al.* 2023; Sharma *et al.* 2014). The high representation of herbs reflects a combination of ecological and cultural factors: their broad amplitude in disturbed habitats; their rapid regeneration after harvesting; their ease of detection and collection without specialized tools; and their continuous availability across seasons (Borah *et al.* 2025). Home Gardens (50.67%) were the main source of magico-religious plants, followed by roadside (29.33%), forests (17.33% each), marshy areas (2.67%), and agricultural fields (1.33%). Plants were categorized into three categories, namely MAG (magical), SAR (sacred and religious),

and SC (Social ceremonies), based on magico-religious practices. As shown in Table 2, SAR was the dominant use category with 48 plant species.

Plant part used

In magico-religious practices, the most commonly used plant parts were leaves (30%), followed by whole plants (21%), flowers (13% each), twigs and stems (10% each), fruit (9%), seeds (4%), and rhizomes (1%). This pattern indicates that plant selection for ritual purposes is not random but is influenced by perceived efficacy, accessibility, symbolic significance, and culturally transmitted knowledge associated with particular plant organs. The predominant use of leaves in the present study may be due to their year-round availability and ease of collection. Furthermore, the use of whole plants by local people in the study area is particularly noteworthy, as it displays a holistic view of plants rather than the functional use of their parts. The present findings on the use of different plant parts in magico-religious practices align with earlier reports (Sharma *et al.* 2022; Rawat & Kumar 2024; Singh *et al.* 2024b). Fruits and whole plants are mainly used for offerings in social and religious ceremonies.

Use reports (URs)

Among all recorded species, the most cited was *Mangifera indica* together with *Wallaceodoxa raja-ampat* (UR = 80) (Table 3), indicating its widespread use and strong association with ritualistic and ceremonial practices. The leaves and branches of *Mangifera indica* are crucial in social ceremonies (Sharma *et al.* 2014). *Mangifera indica* is also reported for religious purposes in previous studies (Sharma & Joshi 2010, Sharma *et al.* 2022, Rawat and Kumar 2024). In contrast, the fewest use reports (UR = 8) were recorded for *Euphorbia hirta*, indicating that the magico-religious applications of this species were relatively limited and known to only a few informants. The variation in UR values indicates an unequal distribution of traditional knowledge and a variable degree of importance assigned to individual plant species.

Relative Frequency of Citation (RFC)

The RFC values indicated the degree of recognition of individual species among the 102 informants interviewed. *Mangifera indica* and *Wallaceodoxa raja-ampat* had the highest RFC value (0.784) (Table 3), indicating that many respondents cited these species and that it holds a prominent position in the cultural practices of the study area. The high RFC value reflects that the species is widely recognized and well known among inhabitants of the study area (Kayani *et al.* 2014). On the other hand, *Euphorbia hirta, Ardisia solanacea, Spiraea thunbergii,* and *Thelypteris parasitica* had the lowest RFC value (0.078), indicating that it was unfamiliar and infrequently cited by the participants. Species with higher RFC values can be considered culturally important and reflect well-preserved traditional knowledge within the community.

Cultural Importance Index (CI) and Cultural Value Index (CV)

The significance of certain species in the magico-religious practices of Sivasagar district also emerged from the CI and CV Indices. The highest CI and CV values were observed for *Mangifera indica* (0.79 and 0.415, respectively; Table 3), suggesting that this species is of high cultural significance, as it is identified by informants and used in several ritual contexts. Similar observations have been reported in other ethnobotanical investigations, in which species of high cultural importance were associated with ritual ceremonies and religious beliefs (Thakur *et al.* 2023; Rawat & Kumar 2024). The Hajong community in Assam venerates *M. indica* as a sacred home of deities and considers its leaves crucial for rituals, success, and removal of evil spirits (Sharma *et al.* 2012). Furthermore, Ahom and Bodo communities use leaf decoction to treat diabetes (Konwar *et al.* 2024). Besides, the Chorei tribes of Southern Assam consume raw fruit of these plants to prevent constipation (Choudhury *et al.* 2012). Therefore, the cultural resonance of a plant species increases substantially when its utility increases. In previous studies, *Ocimum sanctum* has the highest CV in the Kullu district of Himachal Pradesh (Thakur *et al.* 2023); *Hordeum vulgare* ranked first in CV in Himachal Pradesh (Rawat & Kumar 2024). On the other hand, the lowest CI (0.08) and CV (0.002) values were recorded for *Euphorbia hirta*, *Ardisia solanacea*, *Spiraea thunbergii*, and *Thelypteris parasitica*, indicating their comparatively limited cultural recognition and restricted integration into the documented magico-religious practices. In general, high CI and CV values show that the species is recognized by a larger proportion of informants and possesses greater cultural importance within the community (Gurung *et al.* 2026). Besides, for sacred and religious use, leaves of *O. sanctum* are used to treat cough and sore throat by the Mishing community in Assam (Gogoi *et al.* 2026). Likewise, the local people in the Spiti Valley of the Northern Himalaya use the seed of *H. vulgare* to treat diarrhea, general weakness and as a galactagogue (Bishist *et al.* 2022). It is utilized as fodder and medicine in the higher regions of India and serves as a crucial resource for local livelihoods (Haq *et al.* 2022; Singh *et al.* 2024c).

Table 2. Traditionally used magico-religious plants, their families, scientific names, vernacular names, habits, plant part used, and their uses.

Family	Botanical name/ Collection no.	Vernacular name	Source	Habit	Part used	Use category	Uses	FC
Anacardiaceae	*Mangifera indica* L. CSIRNEIST091	Aam goch	HG	T	L	SAR, SC	Leaves are used in Pooja because they repel negative energy (25). Leaves are also used to decorate the house's main entrance during the marriage ceremony (55).	80
Apiaceae	*Hydrocotyle sibthorpioides* Lam. CSIRNEIST092	Horu manimuni	HG	H	WP	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (29).	29
	Centella asiatica (L.) Urb CSIRNEIST093	Bor Manimuni	HG	H	WP	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (43).	43
Apocynaceae	*Tabernaemontana divaricata* (L.) R.Br. Ex Roem. & Schult. CSIRNEIST094	Kothona	HG	S	FL	SAR	It is considered a sacred plant, and its flowers are offered to Sitala Devi and Aai during "Aai dekha diya" (chickenpox) (66).	66
	Calotropis gigantea (L.) W.T.Aiton CSIRNEIST095	Aakon atha	R	H	L	SAR	The leaves are offered to Shani Dev and Lord Hanuman. Moreover, it is traditionally used to treat mumps (21).	21
	Nerium oleander L. CSIRNEIST096	Karabi	HG	S	FL	SAR	The plant is considered sacred, and its flowers are offered to Surya dev (28).	28
Araceae	*Colocasia esculenta* (L.) Schott CSIRNEIST097	Kola kochu	R	H	WP	MAG	The whole plant is planted in the paddy field during the first planting season to increase yield (36).	36
Arecaceae	*Wallaceodoxa raja-ampat* Heatubun & W.J.Baker CSIRNEIST098	Tamul	HG	T	FR	SC	The nut is considered culturally important and used in every ritual in Assam, such as Pooja, weddings, and festivals, to pay respects to deities (80).	80
	Phoenix sylvestris (L.) Roxb. CSIRNEIST099	Khejur	R	T	FR	MAG, SAR	Nuts are used for evil eye protection (6) and offered to Lord Hanuman (12).	18
					L	SC	Leaves are used in decoration during the marriage ceremony (10).	10
Asteraceae	*Tagetes erecta* L. CSIRNEIST100	Narzi phool	HG	H	FL	SC	Flowers are used in Varmala during the marriage ceremony. Flowers are	11

							also offered to the deities during various rituals. They are also used in decoration during Diwali and marriage ceremonies (11).	
Caryophyllaceae	*Drymaria cordata* (L.) Willd. ex Schult. CSIRNEIST501	Lai jabori	HG	H	WP	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (20).	20
Combretaceae	*Terminalia chebula* Retz. CSIRNEIST502	Hilikha	HG	T	FR	SAR	It is considered a sacred plant and is used in various rituals (61).	61
Cucurbitaceae	*Cucumis melo* L. CSIRNEIST503	bhul	HG	C	L	SC	The leaves are used to offer food to ancestors during the post-funeral ritual (13).	13
	Benincasa hispida (Thunb.) Cogn. CSIRNEIST504	Kumura	HG	C	FR	SAR	The fruit is often used as a symbolic bali instead of animal sacrifice (21).	21
Eleocarpaceae	*Elaeocarpus sphaericus* (Gaertn.) Heer CSIRNEIST505	Rudrakhya	HG	T	S	MAG	The beads are believed to possess protective and healing properties and are commonly used in ritualistic, tantric, and meditative practices (33).	33
Euphorbiaceae	*Jatropha curcas* L. CSIRNEIST506	Bongali erena	R	H	L	MAG	The plant is used for protection against evil influences and supernatural forces. The species is frequently planted around homesteads and sacred sites as a spiritual safeguard (17).	17
	Euphorbia hirta L. CSIRNEIST507	Gakhiroti bon	R	H	WP	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (8).	8
	Ricinus communis L. CSIRNEIST508	Ronga era	R	H	S	MAG	plant is used by several indigenous communities for protection against evil influences, purification rituals, and folk healing practices. The species also possesses considerable ethnomedicinal importance (14).	10
Fabaceae	*Flemingia strobilifera* (L.) W.T. Aiton CSIRNEIST509	Makhiyati	HG	S	T	MAG	It is traditionally used during Goru Bihu to bathe cattle as a protective measure against the evil eye, disease, and other negative supernatural influences (28).	28

	Ohwia caudata (Thunb.) H.Ohashi CSIRNEIST510	Biyoni haputa	R	H	WP	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (15).	15
	Clitoria ternatea L. CSIRNEIST511	Aparajita	HG	C	FL	SAR	The flower is used in goddess worship, ritual offerings, and folk protective practices. The species is believed to confer spiritual protection and auspiciousness and also possesses important ethnomedicinal value (21).	21
	Saraca asoca (Roxb.) W.J.de Wilde CSIRNEIST512	Akhook	HG	S	FL	SAR	It is traditionally regarded as a sacred magico-religious tree associated with prosperity, protection, and feminine divinity. Flowers are offered in Devi puja (22).	22
	Butea monosperma (Lam.) Kuntze CSIRNEIST513	Polax	R	T	FL	SAR	It is traditionally regarded as a sacred magico-religious tree used in ritual ceremonies, folk healing practices, and protective spiritual observances. Flowers are offered to Lord Shiva (9).	9
Gnetaceae	*Gnetum gnemon* L. CSIRNEIST514	Vomloti	F	S	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (11).	11
Lamiaceae	*Ocimum tenuiflorum* L. CSIRNEIST515	tulokhi	HG	H	WP	SAR	It is an important magico-religious plant traditionally worshipped during Kati Bihu. Earthen lamps are lit near the Tulsi plant to invoke protection, prosperity, and good harvest while warding off evil influences and crop damage (64).	64
	Clerodendrum glandulosum Lindl. CSIRNEIST516	Temena	F	S	L	SAR	It is used in the preparation of traditional rice beer, which they offer to deities during various rituals (15).	15
	Leucas aspera (Willd.) Link CSIRNEIST517	Durun bon	R	H	T	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (78).	78
	Ocimum basilicum L. CSIRNEIST518	Lakhimi phool	HG	H	T	SAR	It is used in the preparation of traditional rice beer, which they	19

							offered to deities during various rituals (19).	
	Clerodendrum infortunatum L. CSIRNEIST520	Dhopat tita	R	H	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (15).	15
Lauraceae	*Cinnamomum verum* J.Preslm CSIRNEIST521	Patihuta	F	T	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (20).	20
	Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm. CSIRNEIST522	Tezpat	HG	H	L	SAR, MAG	It is traditionally valued as a sacred aromatic plant used in ritual cooking, ceremonial offerings, and household purification practices (26). The species is culturally associated with auspiciousness, protection, and spiritual well-being (8)	26
Lygodiaceae	*Lygodium microphyllum* (Cav.) R.Br. CSIRNEIST523	Horu kopoudhekia	F	H	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (54).	54
	Lygodium japonicum (Thunb.) Sw. CSIRNEIST524	Maju Kopou dhekia	F	H	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (56).	56
	Lygodium flexuosum (L.) Sw. CSIRNEIST525	Bor kopou dhekia	F	H	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (42).	42
Lythraceae	*Lawsonia inermis* L. CSIRNEIST526	Jetuka	HG	S	L	MAG	The leaf paste is applied to the hands and feet for beautification, auspiciousness, protection from evil influences, and festive purification (46).	46
Malvaceae	*Hibiscus rosa-sinensis* L. CSIRNEIST527	Ronga joba	HG	S	FL	SAR	Flowers are used in Shakta worship, tantric rituals, and ceremonial offerings to goddess deities. The species symbolizes divine feminine power, protection, and spiritual	32

							energy and also possesses important ethnomedicinal value (32).	
Marantaceae	*Schumannianthus benthamianus* (Kuntze) Veldkamp & I.M.Turner CSIRNEIST528	Patidoi	M	H	WP	MAG	It is traditionally used during wedding ceremonies for the bride's ritual bathing. The practice is associated with purification, protection from evil influences, and blessings for prosperity and marital well-being, reflecting the magico-religious significance of the species in Assamese culture (31).	31
Meliaceae	*Azadirachta indica A. Juss.* CSIRNEIST529	Neemgoch	HG	T	L	MAG	Leaves are traditionally used during “Aai Dekha” (chickenpox) rituals, where Neem leaves are placed around the patient for protection, purification, and healing. The species is culturally associated with appeasing the disease goddess and preventing negative supernatural influences (67).	67
Menispermaceae	*Tinospora cordifolia* (Willd.) Hook.f. & Thomson CSIRNEIST530	Tongloti	HG	H	T	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (54).	54
	Stephania hernandifolia Walp. CSIRNEIST531	tubuki lota	F	C	T	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (32).	32
	Nyctanthes arbor-tristis L. CSIRNEIST532	Xewali	HG	S	FL	SAR	The fragrant flowers symbolize purity and spiritual peace and are widely utilized in household and temple ceremonies. Flowers are offered to Durga Devi during Durga Puja (29).	29
Moraceae	*Streblus asper* Lour. CSIRNEIST533	Hura goch	F	T	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (32).	32
	Artocarpus heterophyllus Lam. CSIRNEIST534	Kothal goch	HG	T	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (37).	37

	Ficus religiosa L. CSIRNEIST535	Aahat Goch	R	T	WP	SAR	The tree is associated with divine worship, spiritual purification, and protection from evil influences (71).	71
	Ficus benghalensis L. CSIRNEIST536	Bot goch	R	T	WP	MAG	The tree is associated with divine and ancestral spirits. Several folk taboos prohibit cutting or disturbing the tree, reflecting its strong spiritual and cultural significance (74).	74
	Ficus racemosa L. CSIRNEIST537	Jagya dimoru	R	T	ST	SAR	It is traditionally used in Jagya (yajna) ceremonies where its wood serves as sacred fuel for ritual fire offerings. The species is culturally associated with purification and divine worship (71).	71
	Maclura cochinchinensis (Lour.) Corner CSIRNEIST538	Puli Kait	F	C	ST	MAG	Climber is traditionally placed at the main entrance of houses during Bohag Bihu to protect the household from negativity, evil eye, and harmful supernatural influences (46).	46
Musaceae	*Musa spp.* CSIRNEIST519	Kol goch	HG	H	WP	SC	*Musa* spp. are traditionally regarded as sacred magico-religious plants used in religious ceremonies, wedding rituals, and festive observances. The species symbolizes prosperity, fertility, and ritual purity and occupies an important position in Assamese folk culture (67).	67
Myrtaceae	*Psidium guajava* L. CSIRNEIST539	Madhuri	HG	T	ST	SAR	The stem of the species is traditionally used during Me-Dam-Me-Phi ceremonies of the Ahom community for ritual chicken sacrifice (bali) (39).	39
Nyctaginaceae	*Mirabilis jalapa* L. CSIRNEIST540	Jayanti phool	R	H	FL	SAR	It is used during Durga Puja, where its flowers are offered to Goddess Durga as symbols of devotion, purity, and auspiciousness (54).	54
Phyllanthaceae	*Antidesma acidum* Retz. CSIRNEIST541	Helech	F	T	WP	MAG	The whole plant is planted in the paddy field during the ritual of the first plantation season to increase the yield (44).	44
	Phyllanthus emblica L. CSIRNEIST542	Aamlokhi	HG	T	WP	MAG	It is planted in the front yard of households due to the belief that the	10

							species brings positive energy, prosperity, and protection (10).	
Piperaceae	*Piper betle* L. CSIRNEIST543	Pan	HG	C	L	SC	Leaves are used in ritual offerings, social ceremonies, ancestral worship, and folk healing practices. The species symbolizes auspiciousness, hospitality, and spiritual purity in Assamese culture (56).	56
	Piper retrofractum Vahl CSIRNEIST544	Paanchoi	R	C	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (43).	43
	Piper nigrum L. CSIRNEIST545	Jaluk	HG	C	S	MAG	It is traditionally used in folk medicinal and magico-religious practices for protection against evil influences and purification of ritual spaces (61).	61
Plantaginaceae	*Plantago major* L. CSIRNEIST546	Hingabon	R	H	WP	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (32).	32
Poaceae	*Cynodon dactylon* (L.) Pers. CSIRNEIST547	Dubori bon	R	H	WP	SAR	It is traditionally regarded as a sacred magico-religious grass used in ritual offerings, purification ceremonies, and protective folk practices (53).	53
	Oryza sativa L. CSIRNEIST548	Dhan goch	FI	H	T	SAR	It is traditionally regarded as the symbolic representation of Goddess Lakshmi and is closely associated with prosperity, fertility, and household wellbeing. Paddy and rice are extensively utilized in ritual ceremonies (56).	56
	Bambusa tulda Roxb. CSIRNEIST549	Bah goch	R	H	ST	SC	The species is extensively utilized in ritual constructions, Bihu festivals, marriage ceremonies, and funeral rites (64).	64
	Saccharum officinarum L. CSIRNEIST550	Kuhiyar	HG	H	ST	SAR	It is traditionally used in ritual ceremonies and festive observances as a symbol of prosperity, abundance, and auspiciousness (62).	62

Polygonaceae	*Persicaria hydropiper* (L.) Delarbre CSIRNEIST557	Bilongoni	M	H	T	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (9).	9
Primulaceae	*Ardisia solanacea* Roxb. CSIRNEIST558	Dhakonpoita	F	S	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (8).	8
Punicaceae	*Punica granatum* L. CSIRNEIST559	Dalim	HG	S	FR	SAR	It is offered in Durga Puja, a symbol of fertility and Shakti (21).	21
Rhamnaceae	*Ziziphus jujuba* Mill. CSIRNEIST560	Bogori	HG	S	ST	MAG	Dried thorny stems are traditionally used as “Jeng” near newborn infants and household entrances to protect against evil spirits, negative energies, and the evil eye (60).	60
Rosaceae	*Spiraea thunbergii* Siebold ex Blume CSIRNEIST565	Singkora	HG	H	T	SAR	It is traditionally used during Me-Dam-Me-Phi ceremonies as an offering to deities and ancestral spirits (8).	8
Rubiaceae	*Rubus alceifolius* Poir. CSIRNEIST561	Jejelipoka	F	C	ST	MAG	It is traditionally associated with protective folk beliefs where thorny wild plants are regarded as barriers against evil influences and negative energies (43).	43
Rutaceae	*Zanthoxylum hamiltonianum* Wall. Ex Hook.F CSIRNEIST562	Tezmoi	F	H	L	SAR	It is used in the preparation of traditional rice beer, which they offered to deities during various rituals (48).	48
	Citrus × limon (L.) Osbeck CSIRNEIST551	Gulnemu	HG	S	FR	MAG	It is traditionally used in magico-religious and folk healing practices for protection against the evil eye and negative energies (61).	61
	Aegle marmelos (L.) Corrêa CSIRNEIST552	Bel goch	HG	S	L	SAR	It is regarded as a sacred magico-religious plant extensively used in Shiva worship and ritual ceremonies. The species is culturally associated with purification and divine blessings (68).	68
Scrophulariaceae	*Scoparia dulcis* L. CSIRNEIST553	Bon tulokhi	R	H	WP	SAR	It is used in the preparation of traditional rice beer, which they	31

							offered to deities during various rituals (31).	
Smilaceae	*Smilax zeylanica* L. CSIRNEIST554	Tikoni Barua	HG	H	ST	MAG	It is placed at the main entrance of households during Bohag Bihu to protect the home from evil influences and negative energies (32).	32
Solanaceae	*Capsicum annuum* L. CSIRNEIST555	Kon jolokia	HG	H	FR	MAG	It is traditionally used in magico-religious and folk healing practices for protection against the evil eye and negative energies (22).	22
	Datura stramonium L. CSIRNEIST556	Dhatura	R	H	FL	SAR, MAG	Plant is traditionally regarded as a sacred magico-religious plant associated with Lord Shiva (38) and tantric ritual practices (3)	40
Thelypteridaceae	*Thelypteris parasitica* (L.) Tardieu CSIRNEIST563	Bihlongoni	R	H	L	MAG	It is traditionally associated with occult and magico-religious practices, in which the species is believed to possess mystical and protective properties (8).	8
Zingiberaceae	*Curcuma longa* L. CSIRNEIST565	Halodhi	HG	H	R	MAG	It is traditionally used in pre-wedding rituals, where turmeric paste is applied to and used to bathe the bride and groom. The species symbolizes purification, auspiciousness, fertility, and protection from evil influences (67).	67

Abbreviations: HG- Home garden, R- Roadside, F- Forest, M- Marshy, FI- Field, H- Herb, SH- Shrub, T- Tree, C- Climber, WP- Whole Plant, FL- Flower, Fr- Fruit, S- Seed, ST- Stem, R- Rhizome, L- Leaves, T- Twigs, MAG- Magic beliefs, SAR- Sacred, SC- Social Ceremonies, DD- Data Deficient, LC- Least Concern, NA- Not Applicable, LC- Least Count, NT- Near Threatened, VU- Vulnerable

Table 3. Quantitative analysis of the importance indices of the plant species reported in the present study.

Botanical name/ Collection no.	UR	NU	CI			Total CI	RFC	CV	IUCN status
			MAG	SC	SAR				
Mangifera indica L. CSIRNEIST091	80	2	0	0.54	0.25	0.79	0.784	0.41	DD
Hydrocotyle sibthorpioides Lam. CSIRNEIST092	29	1	0	0	0.28	0.28	0.284	0.026	NA
Centella asiatica (L.) Urb CSIRNEIST093	43	1	0	0	0.42	0.42	0.421	0.058	LC
Tabernaemontana divaricata (L.) R.Br. Ex Roem. & Schult. CSIRNEIST094	66	1	0	0	0.65	0.65	0.647	0.139	LC
Calotropis gigantea (L.) W.T.Aiton CSIRNEIST095	21	1	0	0	0.21	0.21	0.205	0.014	NA
Nerium oleander L. CSIRNEIST096	28	1	0	0	0.27	0.27	0.274	0.024	LC
Colocasia esculenta (L.) Schott CSIRNEIST097	36	1	0.35	0	0	0.35	0.353	0.041	LC
Wallaceodoxa raja-ampat Heatubun & W.J.Baker CSIRNEIST098	80	1	0	0.78	0	0.78	0.784	0.202	NA
Phoenix sylvestris (L.) Roxb. CSIRNEIST099	28	3	0.06	0	0.12	0.18	0.176	0.048	NA
			0	0.09	0	0.09			NA
Tagetes erecta L. CSIRNEIST100	11	1	0	0.11	0	0.11	0.108	0.004	NA
Drymaria cordata (L.) Willd. ex Schult. CSIRNEIST501	20	1	0	0	0.2	0.2	0.196	0.013	NA
Terminalia chebula Retz. CSIRNEIST502	61	1	0	0	0.6	0.6	0.598	0.118	LC
Cucumis melo L. CSIRNEIST503	13	1	0	0.13	0	0.13	0.127	0.005	NA
Benincasa hispida (Thunb.) Cogn. CSIRNEIST504	21	1	0	0	0.21	0.21	0.206	0.014	NA
Elaeocarpus sphaericus (Gaertn.) Heer CSIRNEIST505	33	1	0.32	0	0	0.32	0.324	0.034	NA
Jatropha curcas L. CSIRNEIST506	17	1	0.17	0	0	0.17	0.167	0.009	LC
Euphorbia hirta L. CSIRNEIST507	8	1	0	0	0.08	0.08	0.078	0.002	NA
Ricinus communis L. CSIRNEIST508	10	1	0.1	0	0	0.1	0.098	0.003	LC
Flemingia strobilifera (L.) W.T. Aiton CSIRNEIST509	28	1	0.28	0	0	0.28	0.275	0.025	NA
Ohwia caudata (Thunb.) H.Ohashi CSIRNEIST510	15	1	0	0	0.15	0.15	0.147	0.007	NA
Clitoria ternatea L. CSIRNEIST511	21	1	0	0	0.21	0.21	0.206	0.014	NA
Saraca asoca (Roxb.) W.J.de Wilde CSIRNEIST512	22	1	0	0	0.22	0.22	0.216	0.016	NT
Butea monosperma (Lam.) Kuntze CSIRNEIST513	9	1	0	0	0.09	0.09	0.088	0.003	LC
Gnetum gnemon L. CSIRNEIST514	11	1	0	0	0.11	0.11	0.108	0.004	LC
Ocimum tenuiflorum L. CSIRNEIST515	64	1	0	0	0.63	0.63	0.627	0.13	NA
Clerodendrum glandulosum Lindl. CSIRNEIST516	15	1	0	0	0.15	0.15	0.147	0.007	NA
Leucas aspera (Willd.) Link CSIRNEIST517	78	1	0	0	0.76	0.76	0.765	0.192	NA
Ocimum basilicum L. CSIRNEIST518	19	1	0	0	0.19	0.19	0.186	0.012	NA
Clerodendrum infortunatum L. CSIRNEIST520	15	1	0	0	0.15	0.15	0.147	0.007	NA
Cinnamomum verum J.Preslm CSIRNEIST521	20	1	0	0	0.2	0.2	0.196	0.013	VU
Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm. CSIRNEIST522	34	2	0.25	0	0.08	0.33	0.255	0.056	LC

Lygodium microphyllum (Cav.) R.Br. CSIRNEIST523	54	1	0	0	0.53	0.53	0.529	0.093	LC
Lygodium japonicum (Thunb.) Sw. CSIRNEIST524	56	1	0	0	0.55	0.55	0.549	0.1	NA
Lygodium flexuosum (L.) Sw. CSIRNEIST525	42	1	0	0	0.41	0.41	0.412	0.056	NA
Lawsonia inermis L. CSIRNEIST526	46	1	0.45	0	0	0.45	0.451	0.067	NA
Hibiscus rosa-sinensis L. CSIRNEIST527	32	1	0	0	0.31	0.31	0.314	0.032	NA
Schumannianthus benthamianus (Kuntze) Veldkamp & I.M.Turner CSIRNEIST528	31	1	0.3	0	0	0.3	0.304	0.03	NA
Azadirachta indica A. Juss. CSIRNEIST529	67	1	0.66	0	0	0.66	0.657	0.143	LC
Tinospora cordifolia (Willd.) Hook.f. & Thomson CSIRNEIST530	54	1	0	0	0.53	0.53	0.529	0.092	NA
Stephania hernandifolia Walp. CSIRNEIST531	32	1	0	0	0.31	0.31	0.314	0.032	NA
Nyctanthes arbor-tristis L. CSIRNEIST532	29	1	0	0	0.28	0.28	0.284	0.026	LC
Streblus asper Lour. CSIRNEIST533	32	1	0	0	0.31	0.31	0.314	0.032	LC
Artocarpus heterophyllus Lam. CSIRNEIST534	37	1	0	0	0.36	0.36	0.363	0.043	NA
Ficus religiosa L. CSIRNEIST535	71	1	0	0	0.7	0.7	0.696	0.161	LC
Ficus benghalensis L. CSIRNEIST536	74	1	0.73	0	0	0.73	0.725	0.175	NA
Ficus racemosa L. CSIRNEIST537	71	1	0	0	0.7	0.7	0.696	0.161	NA
Maclura cochinchinensis (Lour.) Corner CSIRNEIST538	46	1	0.45	0	0	0.45	0.451	0.067	NA
Musa spp. CSIRNEIST519	67	1	0	0	0.66	0.66	0.657	0.143	LC
Psidium guajava L. CSIRNEIST539	39	1	0	0	0.38	0.38	0.382	0.048	LC
Mirabilis jalapa L. CSIRNEIST540	54	1	0	0	0.53	0.53	0.529	0.092	NA
Antidesma acidum Retz. CSIRNEIST541	44	1	0.43	0	0	0.43	0.431	0.061	LC
Phyllanthus emblica L. CSIRNEIST542	10	1	0.1	0	0	0.1	0.098	0.003	LC
Piper betle L. CSIRNEIST543	56	1	0	0	0.55	0.55	0.549	0.1	NA
Piper retrofractum Vahl CSIRNEIST544	43	1	0	0	0.42	0.42	0.422	0.058	NA
Piper nigrum L. CSIRNEIST545	61	1	0.6	0	0	0.6	0.598	0.118	NA
Plantago major L. CSIRNEIST546	32	1	0	0	0.31	0.31	0.314	0.032	LC
Cynodon dactylon (L.) Pers. CSIRNEIST547	53	1	0	0	0.52	0.52	0.52	0.089	NA
Oryza sativa L. CSIRNEIST548	56	1	0	0	0.55	0.55	0.549	0.1	LC
Bambusa tulda Roxb. CSIRNEIST549	64	1	0	0.63	0	0.63	0.627	0.13	NA
Saccharum officinarum L. CSIRNEIST550	62	1	0	0	0.61	0.61	0.608	0.122	NA
Persicaria hydropiper (L.) Delarbre CSIRNEIST557	9	1	0	0	0.09	0.09	0.088	0.003	LC
Ardisia solanacea Roxb. CSIRNEIST558	8	1	0	0	0.08	0.08	0.078	0.002	LC
Punica granatum L. CSIRNEIST559	21	1	0	0	0.21	0.21	0.206	0.014	LC
Ziziphus jujuba Mill. CSIRNEIST560	60	1	0.59	0	0	0.59	0.588	0.114	LC
Spiraea thunbergii Siebold ex Blume CSIRNEIST565	8	1	0	0	0.08	0.08	0.078	0.002	NA
Rubus alceifolius Poir. CSIRNEIST561	43	1	0	0	0.42	0.42	0.422	0.058	NA
Zanthoxylum hamiltonianum Wall. Ex Hook.F CSIRNEIST562	48	1	0	0	0.47	0.47	0.471	0.073	NA
Citrus × limon (L.) Osbeck CSIRNEIST551	61	1	0.6	0	0	0.6	0.598	0.118	LC
Aegle marmelos (L.) Corrêa CSIRNEIST552	68	1	0	0	0.67	0.67	0.667	0.147	NT

Scoparia dulcis L. CSIRNEIST553	31	1	0	0	0.3	0.3	0.304	0.03	NA
Smilax zeylanica L. CSIRNEIST554	32	1	0.31	0	0	0.31	0.314	0.032	NA
Capsicum annuum L. CSIRNEIST555	22	1	0.22	0	0	0.22	0.216	0.016	LC
Datura stramonium L. CSIRNEIST556	41	2	0.37	0	0.03	0.4	0.392	0.105	NA
Thelypteris parasitica (L.) Tardieu CSIRNEIST563	8	1	0.08	0	0	0.08	0.078	0.002	NA
Curcuma longa L. CSIRNEIST565	67	1	0.66	0	0	0.66	0.657	0.143	DD

Informant Consensus Factor

The use category SC had the highest ICF value among the magico-religious practice use categories (Table 4). The highest ICF value, 0.982, was obtained from the highest number of use reports for plant species. The MAG usage category had an ICF value of 0.975.

Table 4. Numbers of use reports, species, and ICF values for magico-religious plant use categories.

Use category	Code	Use Reports (Nur)	No. of Species (Nt)	Nur–Nt	Nur–1	ICF
Magic beliefs	MAG	898	23	875	897	0.975
Sacred	SAR	1834	48	1786	1833	0.974
Social ceremonies	SC	400	8	392	399	0.982

The SAR usage category had an ICF of 0.974. The high ICF values for the MAG and SAR categories identified in this study indicate that informants possess substantial knowledge of magico-religious plants commonly used by indigenous communities in this region, despite considerable variation in traditions and cultural customs, eco-climatic conditions, vegetation, and physiographic regions (Singh *et al.* 2024c). As previously reported, the SC category has a high ICF, as noted in previous studies (Rawat & Kumar 2024). Strong ICF values indicate strong transfer of traditional knowledge among informants. Photographs of some of the plant species have been shown in Figs. 2 and 3.



Figure 2. a-h: Magico-religious plants: a. *Saraca asoca* (Roxb.) W.J.de Wilde, b. *Datura stramonium* L., c. *Tagetes erecta* L., d. *Hibiscus rosa-sinensis* L., e. *Psidium guajava* L., f. *Ocimum basilicum* L., g. *Capsicum annuum* L., h. *Piper nigrum* L.



Figure 3. i-p: Some magico-religious plants: i. *Curcuma longa* L. j. *Ficus religiosa* L., k. *Calotropis gigantea* (L.) W.T.Aiton, l. *Bambusa tulda* Roxb., m. *Cucumis melo* L., n. *Mirabilis jalapa* L., o. *Citrus × limon* (L.) Osbeck, p. *Tabernaemontana divaricata* (L.) R.Br. Ex Roem. & Schult.

Hierarchical Cluster Analysis (HCA)

Hierarchical clustering depicts the grouping of samples into Clusters and the degree of similarity between clusters (Granato *et al.* 2018). In the present context, the similarities among the documented magico-religious plant species were analyzed using the ethnobotanical indices, viz., FC, UR, NU, CI-MAG, CI-SC, CI-SAR, Total CI, RFC, and CV. The results showed substantial differences in ethnobotanical significance and ritual-use patterns among the species, and the species were grouped into two major clusters, viz., Cluster I and Cluster II (Fig. 4). Cluster I comprised species having relatively high frequency of citations (FCs) and Cultural Importance value (CI), indicating the wide recognition of these plant species and their regular use in the ritual practices in the study area. For example, *Azadirachta indica, Ficus benghalensis,* and *Piper nigrum are* used for household protection and purification, whereas *Ficus religiosa, Ficus racemosa, Ocimum tenuiflorum,* and *Aegle marmelos are used for* worship and sacred offerings. Likewise, *Mangifera indica, Wallaceodoxa raja-ampat, Bambusa tulda, Musa spp*., and *Oryza sativa* are used by the local people during major social or seasonal ceremonies. The species of Cluster I includes *Mangifera indica*, *Wallaceodoxa raja-ampat*, *Bambusa tulda*, *Azadirachta indica*, *Ficus benghalensis*, *Piper nigrum*, *Ziziphus jujuba*, *Citrus × limon*, *Curcuma longa*, *Tabernaemontana divaricata*, *Terminalia chebula*, *Ocimum tenuiflorum*, *Leucas aspera*, *Ficus religiosa*, *Ficus racemosa*, *Musa* spp., *Saccharum officinarum*, *Aegle marmelos*, *Lygodium microphyllum*, *Lygodium japonicum*, *Tinospora cordifolia*, *Mirabilis jalapa*, *Cynodon dactylon*, *Piper betle*, *Oryza sativa*, *Piper retrofractum*, *Rubus alceifolius*, and *Zanthoxylum hamiltonianum.* .

Cluster II was more internally heterogeneous and further divided into several subclusters, suggesting differences in ritual functions, cultural importance, and patterns of use among the species. Within Cluster II, the lower-level subclusters are culturally informative because they separate plants according to more specialized or less universally shared ritual roles. For example, Species such *as Jatropha curcas, Ricinus communis, Lawsonia inermis, Maclura cochinchinensis, Smilax zeylanica, Capsicum annuum*, and *Thelypteris parasitica* are mainly associated with magical protection, evil-eye protection, purification, or protection from negative influences, whereas species such as *Saraca asoca, Clitoria ternatea, Tagetes erecta, Hibiscus rosa-sinensis, Nyctanthes arbor-tristis, Punica granatum,* and *Datura stramonium* are more closely linked with deity worship, offerings and various specific religious ceremonies. Other members, including *Hydrocotyle sibthorpioides, Centella asiatica, Drymaria cordata, Euphorbia hirta, Gnetum gnemon, Clerodendrum glandulosum, Lygodium flexuosum, Plantago major,* and *Scoparia dulcis*, share the culturally specific use of plant material in traditional rice-beer preparation offered to deities. Thus,

the heterogeneity of Cluster II reflects a wide range of localized traditions rather than a single dominant ritual function. Species that joined the dendrogram at greater linkage distances had more distinct cultural roles and specialized ritual uses. The species includes in the Cluster II were *Hydrocotyle sibthorpioides, Nerium oleander, Centella asiatica, Calotropis gigantea, Drymaria cordata, Benincasa hispida, Saraca asoca, Clitoria ternatea, Ocimum basilicum, Cinnamomum verum, Tagetes erecta, Cucumis melo, Jatropha curcas, Ricinus communis, Euphorbia hirta, Butea monosperma, Gnetum gnemon, Ohwia caudata, Clerodendrum glandulosum, Clerodendrum infortunatum, Phyllanthus emblica, Thelypteris parasitica, Persicaria hydropiper, Ardisia solanacea, Spiraea thunbergii, Colocasia esculenta, Elaeocarpus sphaericus, Flemingia strobilifera, Schumannianthus benthamianus, Lawsonia inermis, Maclura cochinchinensis, Antidesma acidum, Smilax zeylanica, Capsicum annuum, Lygodium flexuosum, Artocarpus heterophyllus, Psidium guajava, Hibiscus rosa-sinensis, Stephania hernandifolia, Streblus asper, Nyctanthes arbor-tristis, Plantago major, Scoparia dulcis, Punica granatum, Phoenix sylvestris, Cinnamomum tamala,* and *Datura stramonium*.

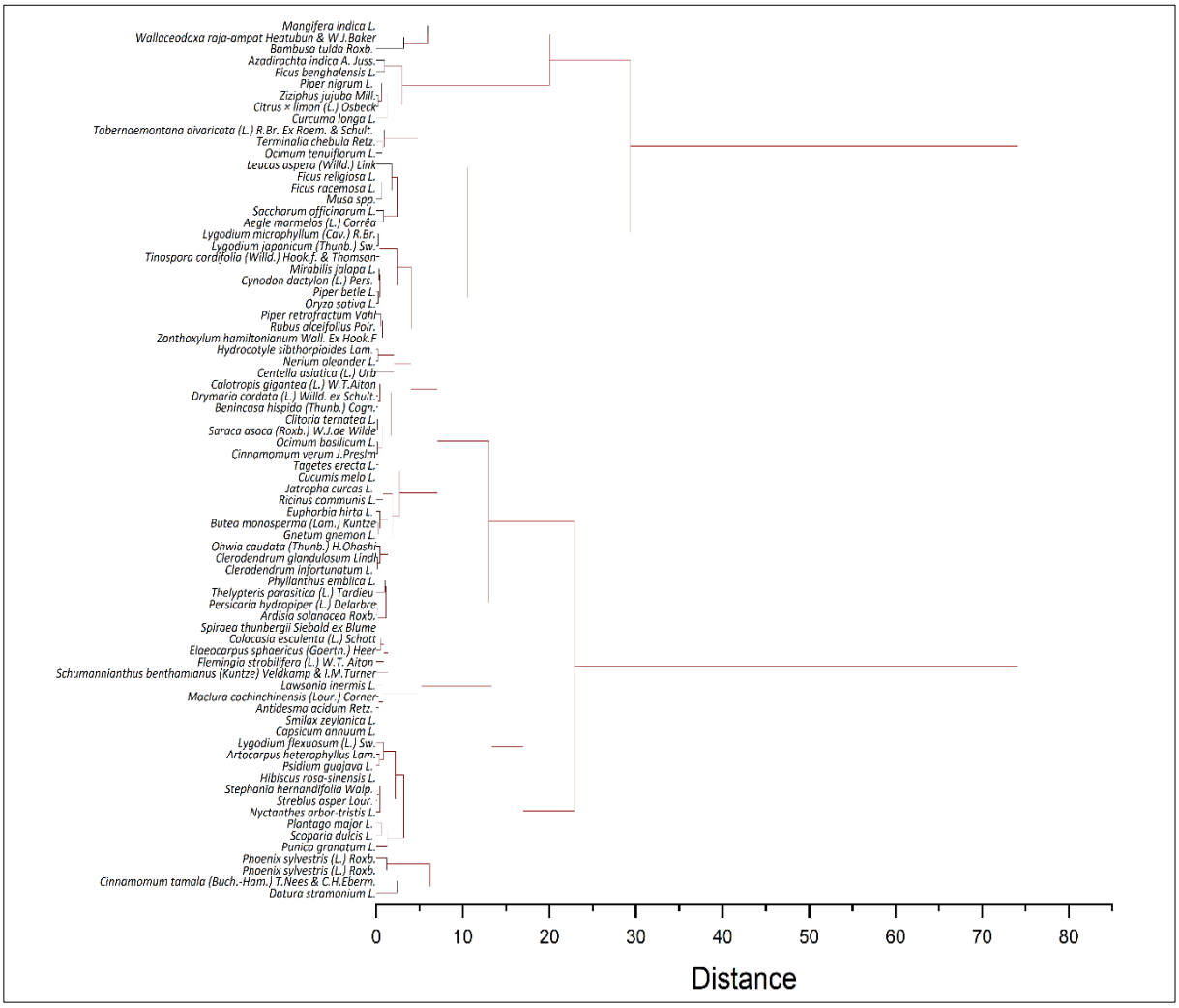

Figure 4. Hierarchical cluster dendrogram showing similarity relationships among magico-religious plant species of Sivasagar District based on ethnobotanical indices using Ward's linkage method and Euclidean distance. Species grouped within the same cluster exhibit similar patterns of cultural importance and ritual utilization.

Similar applications of HCA in ethnobotanical studies have been reported (Granato *et al.* 2018; Gurung *et al.* 2026; Kencharaddi *et al.* 2026). Gurung *et al.* (2026) applied HCA to classify medicinal plants based on ethnobotanical indices. The analyses reveal that magico-religious plant knowledge in Sivasagar District is organized around particular groups of culturally important species, reflecting the diversity and complexity of local ritual traditions.

Jaccard's Index (JI)

A comparative assessment with ethnobotanical studies published earlier from different parts of India (Table 5) revealed similarities and distinct differences in species composition and traditional knowledge. Jaccard Similarity Index (JI) ranged

from 0.039 to 0.193, reflecting the degree of similarity and suggesting wide regional variation in the use and selection of ritual plants. The highest similarities were obtained with Pangging *et al.* (2019) (JI=0.193), followed by Borah *et al.* (2025) (JI=0.159) and Pangging *et al.* (2021) (JI=0.150). Moderate similarity was observed with the studies of Tripura (JI=0.145), Uttarakhand (JI=0.135), Himachal Pradesh (JI=0.119 and 0.099), and Kerala (JI=0.117). Lower similarity values were observed in studies from Odisha (JI = 0.079), Jammu and Kashmir (JI = 0.039 and 0.080), and an earlier report of U. K. Sharma & Pegu (2011) (JI = 0.082). The highest similarity index indicates that these species are culturally important (Singh *et al.* 2024c).

Table 5. Comparison of the present study with previous ethnobotanical studies using Jaccard similarity index (JI).

Study area	No. of plants reported	No. of species in the present study	No. of plants common to the present study	Jaccard Index	References
Assam	30	75	8	0.082	Sharma & Pegu (2011)
Assam	61	75	22	0.193	Pangging *et al.* (2019)
Assam	63	75	18	0.150	Pangging *et al.* (2021)
Upper Assam	115	75	26	0.159	Borah *et al.* (2025)
Tripura, India	59	75	17	0.145	Sharma *et al.* (2014)
Odisha, India	48	75	9	0.079	Sahu *et al.* (2013)
Uttarakhand, India	34	75	13	0.135	Sharma *et al.* (2022)
Himachal Pradesh, India	47	75	11	0.099	Rawat & Kumar (2024)
Jammu and Kashmir, India	32	75	4	0.039	Singh *et al.* (2024b)
Himachal Pradesh, India	75	75	16	0.119	Thakur *et al.* (2023)
Kerala, India	40	75	12	0.117	Pramod *et al.* (2003)
Jammu and Kashmir, India	60	75	10	0.08	Singh *et al.* (2025)

Higher Jaccard similarity values generally indicate a greater overlap in plant species used by different communities, which may result from similar floristic composition, geographical proximity, shared cultural traditions, or the exchange of ethnobotanical knowledge (Gonz´ alez-Tejero *et al.* 2008; Faruque *et al.* 2018). Specifically, high JI values have been attributed to common traditions, cultures, geography, and environmental conditions across the compared regions (Manzoor *et al.* 2023), and among neighbouring communities, they are considered to reflect shared flora and analogous cultural norms (Faruque *et al.* 2018). Comparative surveys of adjacent regions have likewise reported markedly higher JI values with allied areas than with geographically distant ones (Merrouni *et al.* 2021). In contrast, lower JI values reflect greater differences in plant use, often arising from different vegetation, ecological conditions, ethnic diversity, cultural practices, and the local availability of plant resources (Faruque *et al.* 2018). Such low JI values frequently arise from geographic variation in topography, which produces great dissimilarities in site features between the compared regions (Manzoor *et al.* 2023). They also have differences in population size, species diversity, habitat structure, and reduced exchange of cultural knowledge between communities (Siddique *et al.* 2021), and long distances that combine dissimilar flora with culturally divergent traditions (Merrouni *et al.* 2021). Our comparative research shows that although Jaccard similarity scores are fairly low, some species have pan-Indian ritual significance, whereas many others are highly regionally distinctive (Singh *et al.* 2024a). The common occurrence of *Aegle Marmelos, Ocimum tenuiflorum, Curcuma longa, Musa × paradisiaca,* and *Ficus religiosa* indicates that they have long been sacred in Hindu traditions. In turn, some plants in the present study were missing or assigned to different ceremonial purposes than in previous reports, pointing to the dynamic nature of ethnobotanical knowledge, which involves continuous evolution through the abandonment of certain uses and adaptation of new ones (Söukand & Pieroni 2016).

Among the 75 magico-religious plant species reported, 16 species, such as *Calotropis gigantea, Phoenix sylvestris, Cucumis melo, Jatropha curcas, Ricinus communis, Lygodium microphyllum, L. japonicum, L. flexuosum, Maclura cochinchinensis, Schumannianthus benthamianus, Piper retrofractum, Plantago major, Ardisia solanacea, Spiraea thunbergii, Rubus alceifolius* and *Persicaria hydropiper* were not reported for magico-religious uses in the studies included in the present comparative assessment and therefore represent potentially important additions to the comparative ethnobotanical record of the region.

Limitations of the present study

The study has some field-based limitations. Some remote and forested locations were difficult to access because of terrain and field conditions, and therefore a few less-accessible sites may not have been sampled as extensively as easily reachable locations. Communication with some local participants was difficult because of differences in local language and the specific nature of ritual knowledge. Some participants were also hesitant to share certain knowledge related to specific rituals and beliefs. This may have affected the depth and consistency of some responses. Additionally, field visits did not coincide with the flowering stage for all documented taxa; consequently, flowering material was not available for every species during collection, which may have constrained the availability of reproductive characters for field verification. Seasonal variation in plant availability and the timing of field visits may therefore have resulted in under-documentation of some short-lived or seasonally used ritual plants.

Conclusion

The present study documented the cultural dimensions of the plants used by the local communities of the Sivasagar District of Assam, India. The results revealed that plants such as *Wallaceodoxa raja-ampat, Mangifera indica*, *Ocimum sanctum*, and *Hordeum vulgare* are not only symbolic material but active contributors in defining the community's identity and expression of traditional heritage. The dominance of sacred and religious uses, together with consistently high values of the Informant Consensus Factor recorded across all use categories, shows a high level of agreement among respondents and suggests that knowledge of ritual plants is well preserved in the study area and that its transmission within the community is strong. However, the processes of modernization, urbanization, and changing socio-cultural values can jeopardize the transmission of this knowledge to younger generations. Therefore, community-centered approaches like conservation of sacred groves in the studied region and cultivation of essential ceremonial plant species in home gardens should be prioritized so that increasing pressure on wild plant resources may be mitigated. Additionally, it is proposed that the local communities in the study area and neighboring districts be closely monitored and contacted often regarding their beliefs and principles. They must be educated and made cognizant of the value of plant diversity and the tremendous loss that would occur if it is lost. Therefore, this research underscores the importance of recording the traditional knowledge of local communities in the Sivasagar District and other mountainous regions of Assam, while promoting awareness among residents about sustainable practices and the conservation of these essential resources for future optimal use.

Declarations

List of abbreviations: List of abbreviations: HG- Home garden, R- Roadside, F- Forest, M- Marshy, FI- Field, H- Herb, SH- Shrub, T- Tree, C- Climber, WP- Whole Plant, FL- Flower, Fr- Fruit, S- Seed, ST- Stem, R- Rhizome, L- Leaves, T- Twigs, MAG- Magic beliefs, SAR- Sacred, SC- Social Ceremonies, DD- Data Deficient, LC- Least Concern, NA- Not Applicable, LC- Least Count, NT- Near Threatened, VU- Vulnerable

Ethics approval and consent to participate: Verbal prior informal consent was obtained from the participants before the survey.

Consent for publication: Not applicable

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Author contributions: SS planned and designed the work. BB and SA collected the data. KS analyzed and interpreted the data. SS identified the plants. BB and SA wrote the initial draft of the manuscript. SS, KS, and VSG reviewed and edited the manuscript. All authors read and approved the manuscript.

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