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ZINGIBERACEAE SPECIES IN THE KAINA HILL RANGE: A SYNERGISTIC APPROACH TO BIODIVERSITY AND THEIR USES

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ABSTRACT

The present study was carried out during 2023–2024 to document and to evaluate diversity and ecological characteristics of Zingiberaceae species in the Kaina Hill Range, Manipur, focusing on their traditional uses, cultural significance, and conservation status. Quantitative ethnobotanical indices, including Use Value (UV) and Informant Consensus Factor (ICF), were applied to assess cultural importance and knowledge consensus among informants. A total of 25 Zingiberaceae species belonging to 13 genera were recorded, with diverse therapeutic applications such as anti-inflammatory, antimicrobial, hepatoprotective, digestive, and respiratory treatments. *Zingiber officinale* (UV = 1.52), *Curcuma longa* (UV = 1.44), and *Kaempferia galanga* (UV = 1.30) emerged as the most culturally valued species. ICF values were highest for inflammatory conditions (0.925), digestive disorders (0.921), and respiratory ailments (0.912), indicating strong agreement among informants on plant use for these categories. Ecological observations revealed that species occupy varied habitats, from moist valleys and shaded forests to cultivated plots, with phenological patterns largely concentrated during July 2023 to February 2024. Conservation assessment showed that while most species are of Least Concern, several—including *Hedychium flavum*, *Kaempferia galanga*, *Curcuma caesia*, and *Zingiber zerumbet*—fall under Near Threatened or Vulnerable categories, underscoring the need for targeted conservation measures. The findings highlight the Kaina Hill Range as a significant repository of Zingiberaceae diversity with both ethnomedicinal and ecological value, contributing to the documentation of biodiversity and supporting the integration of traditional knowledge into sustainable resource management and conservation planning in Manipur's hill ecosystems.

(Key words: Zingiberaceae, ethnobotany, traditional, indigenous, phytotherapy)

INTRODUCTION

The Zingiberaceae family, commonly known as the ginger family, is one of the most important groups of medicinal and aromatic plants found predominantly in tropical and subtropical regions. Comprising over 50 genera and more than 1,300 species worldwide, the family is well represented in Southeast Asia, including India's Northeastern region (Singh *et al*., 2000; Sirirugsa, 2002). Members of this family are widely recognized for their ethno-medicinal, culinary, ornamental, and cultural significance. In India, particularly in the state of Manipur, Zingiberaceae species have been deeply integrated into indigenous healthcare systems, playing a vital role in traditional healing, rituals, and daily life (Singh *et al*., 2017; Nongdam and Tikendra, 2014; Pandey *et al*., 2024).

Manipur, a biodiversity-rich state located in the Indo-Burma biodiversity hotspot, is home to diverse ethnic communities whose traditional knowledge systems remain largely un-documented. Among the various hill ranges in the state, the Kaina Hill Range in Imphal East district stands out for its relatively undisturbed forest ecosystem and rich repository of medicinal plants, especially those belonging to the Zingiberaceae family. These plants are not only used in treating common ailments like indigestion, inflammation, and respiratory issues, but are also important in addressing chronic conditions such as liver disorders and dermatological problems (Dash *et al*., 2020; Devi and Singh, 2019; Mehta *et al*., 2022). Despite their importance, comprehensive ethno-pharmacological documentation of these species in this particular region has remained limited.

Ethno-pharmacology, which bridges traditional medicine and modern pharmacological science, offers a valuable framework for understanding the bioactive potential of plants used in indigenous health systems (Heinrich and Gibbons, 2001). The local knowledge encoded in the use of these species represents centuries of empirical experimentation and ecological interaction, offering insights not only into healing practices but also into sustainable harvesting, seasonal availability, and conservation priorities. Documentation of this knowledge is critical, especially at a

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time when rapid socio-economic changes and ecological degradation threaten both the biodiversity of these plants and the cultural memory associated with them (Kala *et al*., 2006; Yadav *et al*., 2018). In traditional Manipuri medicine, the rhizomes of Zingiberaceae plants such as *Curcuma longa*, *Kaempferia galanga*, and *Zingiber officinale* are particularly valued for their anti-inflammatory, hepatoprotective, and antimicrobial properties. These uses are increasingly validated by phytochemical and pharmacological studies, which have identified compounds such as curcumin, gingerol, shogaol, zingiberene, and ethylp-methoxycinnamate as potent bioactives (Choudhury *et al*., 2019; Prasad *et al*., 2021; Khan *et al*., 2025; Khan and Sharma, 2024; Khan *et al*., 2024a). Moreover, indigenous preparation techniques—such as decoction, paste application, and raw consumption—are tailored to maximize efficacy, reflecting a sophisticated understanding of plant pharmacokinetics and therapeutic targets (Upadhyay*et al*., 2011; Baruah*et al*., 2022).

The relevance of ethnobotanical studies extends beyond healthcare. Many Zingiberaceae plants are multifunctional, also serving as spices, dyes, cosmetics, and cultural symbols. For instance, *Curcuma caesia* and *Kaempferia rotunda* are used in traditional rituals, while *Alpiniagalanga* and *Amomumaromaticum* are valued for their culinary and digestive properties (Singh *et al*., 2017; Gogoi*et al*., 2018; Khan and Sharma, 2024). This multi-functionality highlights the need for holistic research approaches that account for the ecological, cultural, and economic roles of medicinal plants. Simultaneously, there is growing concern over the conservation status of many Zingiberaceae species. Overharvesting, habitat loss, and lack of cultivation protocols have led to the decline of several important taxa. Species such as *Curcuma caesia*, *Kaempferia galanga*, and *Hedychium spicatum* are listed as Vulnerable or Data Deficient in conservation assessments, indicating the urgency of both in-situ and ex-situ conservation strategies (Tiwari *et al*., 2018; Khan *et al*., 2024b). Understanding local harvesting patterns and ecological niches is vital for developing community-based conservation practices that align with indigenous knowledge systems.

In this context, the present study was undertaken during July 2023 to February 2024 to document and analyze the ethno-pharmacological knowledge associated with 25 Zingiberaceae species found in the Kaina Hill Range of Imphal East district, Manipur. The objectives were to identify the species used in traditional healthcare systems, document the parts used, preparation methods, and modes of administration, explore the therapeutic applications based on both ethno-medicinal use and phytochemical insights, and assess the habitat distribution and conservation status of each species. By bridging traditional knowledge with scientific understanding, this study aimed to contribute to the broader discourse on biodiversity conservation, ethnomedicine, and sustainable resource utilization.

MATERIALS AND METHODS

Study area

The present ethno-pharmacological study was conducted in the Kaina Hill Range, located in Imphal East district of Manipur, India, a region within the Indo-Burma biodiversity hotspot. Geographically, the area lies between 24°522 N to 24°572 N latitude and 94°062 E to 94°122 E longitude, at an elevation ranging from 850 to 1,200 meters above sea level. The region is characterized by a subtropical monsoon climate with significant rainfall from May to October, supporting lush vegetation and diverse flora, including a rich representation of *Zingiberaceae* species. The study was carried out during 2023–2024, encompassing seasonal variations to ensure representative plant collection and observation.

Field collection and ethnobotanical survey

Field surveys was conducted to document plant phenology, local uses, and harvesting patterns. Specimen collection was carried out in collaboration with local individuals familiar with the forest landscape, including traditional healers, village elders, and forest-dependent community members. Plant specimens were collected in their natural habitats, photographed, georeferenced using GPS, and tagged for botanical identification. Voucher specimens were prepared following standard herbarium practices and deposited in the institutional herbarium for future reference and authentication.

Each plant specimen was identified using standard floras and validated with the help of taxonomists, and cross-verified with literature such as Flora of Manipur and Zingiberaceae of India (Singh *et al*., 2000).

Informant selection and interviews

A total of 50 informants were interviewed using semi-structured questionnaires and open-ended interviews. These informants were carefully selected through purposive and snowball sampling techniques to ensure the inclusion of individuals with substantial traditional knowledge. They represented a diverse range of social and occupational groups, including traditional healers or herbal practitioners, village elders, housewives with generational knowledge, and farmers or forest gatherers. The age of the informants ranged from 50 to 80 years, ensuring depth of traditional knowledge and lived experience. Among them, 31 were female and 19 were male, highlighting the crucial role women play in home-based healthcare and the transmission of plant knowledge. For confidentiality and systematic data management, each informant was assigned a unique code (e.g., INF01 to INF50). Their demographic profiles, levels of ethnobotanical knowledge, and plant usage practices were carefully documented and analysed. Prior informed consent—either oral or written—was obtained from all participants, in adherence to the ethical guidelines outlined by the (Anonymous, 2006).

Data collection and documentation

Data were collected on various aspects of ethnobotanical knowledge, including the local names of plants, parts used (such as rhizomes, leaves, and seeds), ailments treated, methods of preparation (e.g., decoction, paste, infusion), and modes of administration (oral or topical). Additional information gathered included seasonal availability, harvesting practices, and perceptions regarding conservation status, such as whether the plants were wild or cultivated and their relative abundance. Observations were meticulously documented in field notebooks, and with prior permission, some interviews were audio-recorded for accuracy. All data were later digitized for analysis. To ensure reliability and internal validity, triangulation was employed, comparing information across different informants to identify consistent patterns and reduce the possibility of bias or misinformation.

Data analysis

The collected ethnobotanical data were descriptively analyzed to determine the frequency of plant part usage, diversity of ailmentstreated, gender-specific patterns in traditional knowledge, and the species with the highest cultural importance. To quantify the ethnobotanical significance and cross-validate the cultural importance of each species, two widely used quantitative indices were applied: Use Value (UV) (Phillips and Gentry 1993) and Informant Consensus Factor (ICF) (Trotter and Logan 1986).

The Use Value is a quantitative measure that reflects the relative importance orversatility of a plant species based on the number of times it was mentioned by informants.

Formula: $UV = \sum U \div N$

Where,

$\sum U$ = Total number of use-reports for a given species.

N = Total number of informants interviewed.

The Informant Consensus Factor helps to assess the homogeneity of knowledge among informants regarding plants used for specific ailment categories. It helps identify which ailment categories have high agreement and are thus culturally and therapeutically significant.

Formula: $ICF = Nur - Nt \div Nur - 1$

Where,

Nur = Number of individual use-reports for a particular ailment category.

Nt = Number of taxa (plant species) used for that ailment category.

RESULTS AND DISCUSSION

The ethno-pharmacological documentation of 25 *Zingiberaceae* species from the Kaina Hill Range, Imphal East district, each with corresponding local names, highlights a profound reservoir of traditional knowledge embedded within indigenous communities. These local names not only serve as identifiers but also reflect the communities' linguistic heritage and practical understanding of plant use. This alignment between folk taxonomy and scientific nomenclature facilitates both local communication and academic integration (Singh *et al*., 2017; Jain, 2005; Thomas *et al*., 2021). The present study was conducted in the Kaina Hill Range, situated in Imphal East district of Manipur, India, a region falling within the Indo-Burma biodiversity hotspot. Geographically, the area lies between 24°522 N to 24°572 N latitude and 94°062 E to 94°122 E longitude, with elevations ranging from 850 to 1,200 meters above sea level. Characterized by a subtropical monsoon climate and significant rainfall between May and October, the region supports rich vegetation, including a diverse representation of *Zingiberaceae* species.

The study was conducted from April 2023 to March 2024, ensuring representation of seasonal phenological changes. Field surveys were conducted to record ethnobotanical information related to plant phenology, traditional uses, and harvesting practices. Plant specimens were collected in collaboration with local individuals, including traditional healers, elderly villagers, and forest gatherers familiar with the natural habitat. Specimens were geo-referenced using GPS, photographed, tagged, and identified using standard floras and validated by taxonomists. Voucher specimens were prepared and deposited at the institutional herbarium. A total of 50 informants were interviewed using semi-structured questionnaires and open-ended interviews. They were selected through purposive and snowball sampling to include diverse perspectives from traditional healers, elders, housewives, and farmers, aged between 50 and 80 years. Among them, 31 were female and 19 were male, indicating the central role of women in preserving and transmitting ethnobotanical knowledge. Prior informed consent—oral or written—was obtained from all participants in accordance with the International Society of Ethnobiology Code of Ethics (2006). Data were collected on local plant names, parts used (rhizomes, leaves, seeds, etc.), ailments treated, methods of preparation (decoction, paste, infusion, etc.), modes of administration (oral or topical), seasonal availability, harvesting patterns, and conservation perceptions. Observations were documented in field notebooks, and some interviews were audio-recorded with permission. Triangulation was employed to ensure internal validity by cross-verifying data among multiple informants.

Among the documented plant parts, rhizomes (Rh) were most frequently used due to their high concentration of secondary metabolites such as curcuminoids, essential oils, terpenoids, and flavonoids. Leaves (Lvs), seeds (Sd), flowers (Fl), and shoots (Sh) were also used but less frequently. This selective use suggests a traditional pharmacognosy system that is both effective and sustainable, often allowing plant regeneration by avoiding destructive harvesting (Srivastava *et al*., 2015; Gogoi*et al*., 2018; Rahman *et al*., 2020).

Traditional modes of use encompassed decoctions, pastes, infusions, powders, raw chewing, and chutneys. Decoctions and pastes were prevalent in treating gastrointestinal and inflammatory disorders, with species such as *Curcuma caesia*, *Kaempferia galanga*, and *Zingiber cassumunar* being commonly used. These preparation methods reflect empirical optimization of bioactive extraction and pharmacokinetics based on the intended ailment (Choudhury *et al*., 2019; Das *et al*., 2016; Baruah*et al*., 2022). Oral and topical routes of administration dominated. Decoctions, powders, and infusions were taken orally for systemic conditions such as indigestion, inflammation, and hepatoprotection, particularly with *Curcuma longa*, *Alpinia galanga*, and *Amomum aromaticum*. Topical applications were used for skin and musculoskeletal conditions using pastes of *Hedychium marginatum* and *Kaempferia galanga*. Interestingly, *Kaempferia parviflora* was reported to be used in encapsulated form, showing integration of traditional practices with modern delivery systems (Dash *et al*., 2020; Chen *etal*., 2019; Sarangthem and Haokip, 2010).

Preparation methods such as boiling, crushing, and drying reveal community-level refinements. Boiling as in *Curcuma caesia* and *Zingiber cassumunar* improved polar compound extraction. Crushing into paste, used with *Hedychium spicatum* or *Curcuma aromatica*, enhanced localized bioavailability. Drying and powdering common with *Alpinia officinarum* and *Curcuma zedoaria*, enhanced shelf-life. Raw consumption of rhizomes or seeds, such as *Amomum aromaticum*, allowed for immediate therapeutic use. These methods reflect centuries of experiential knowledge (Tiwari *et al*., 2018; Upadhyay *et al*., 2011; Nongdam and Tikendra, 2014). The species served a wide range of therapeutic purposes. Anti-inflammatory and antimicrobial applications were most frequently cited, especially for *Curcuma longa*, *Zingiber officinale*, and *Kaempferia galanga*. Digestive and carminative uses were prevalent with *Alpinia nigra*, *Amomum aromaticum*, and *Zingiber zerumbet*. Liver-protective functions were associated with *Hedychium flavum*, *Curcuma caesia*, and *Curcuma longa*. Dermatological and cosmetic uses were found in *Curcuma aromatica* and *Kaempferia rotunda*, while respiratory uses included *Hedychium spicatum*, *Kaempferia galanga*, and *Alpinia galanga*. These align well with pharmacological evidence, indicating a sophisticated indigenous understanding of phytodynamics (Singh *et al*., 2017; Dash *et al*., 2020; Devi and Singh, 2019; Gogoi *et al*., 2018).

The therapeutic potential of these species is rooted in their rich phytoconstituent profiles. *Curcuma longa* and *Curcuma caesia* are known for curcumin and camphor, which have strong anti-inflammatory properties. *Zingiber officinale* contains gingerol, shogaol, and zingiberene, compounds linked to digestive and antiemetic activity. *Kaempferia galanga* yields ethyl p-methoxycinnamate, a potent antimicrobial and anti-inflammatory compound. *Amomum aromaticum* contains borneol and camphor, while *Hedychium* species are rich in essential oils and flavonoids with aromatic and medicinal properties (Srivastava *et al*., 2015; Choudhury *etal*., 2019; Devi and Singh, 2019; Prasad *et al*., 2021).

Seasonal observations showed peak phenological activity and harvest readiness during the monsoon and post-monsoon periods, typically July to October. This seasonal availability corresponds to higher incidences of digestive and respiratory ailments, suggesting an ecological synchronization that ensures timely access to medicinal resources (Tiwari *et al*., 2018; Baruah *et al*., 2022; Thomas *et al*., 2021). Beyond medicine, *Zingiberaceae* plants hold cultural, culinary, and economic significance. *Curcuma longa* and *Zingiber officinale* are valued both as spices and medicines. *Kaempferia galanga* and *Hedychium* spp. are used ornamentally and therapeutically. *Amomum aromaticum* and *Curcuma amada* are prized for aroma, enhancing food and digestive health traditions (Singh *et al*., 2017; Gogoi*et al*., 2018; Jain, 2005).

Habitat-wise, *Alpinia galanga* and *Kaempferia galanga* prefer moist valleys and subtropical forests, while *Hedychium* species occupy hill slopes and forest edges. Widely cultivated species like *Curcuma longa* and *Elettaria cardamomum* are found in gardens and farms, indicating human-mediated adaptation and selection (Dash *et al*., 2020; Nongdam and Tikendra, 2014; Baruah*et al*., 2022). Conservation assessments showed that while many species are listed as Least Concern, several, including *Curcuma caesia*, *Kaempferia galanga*, and *Hedychium spicatum*, are classified as Vulnerable or Data Deficient. This calls for urgent integration of in-situ and ex-situ strategies, sustainable harvesting, population monitoring, and policy-based support. Merging traditional ecological knowledge with scientific conservation approaches is essential to safeguard these culturally and pharmacologically valuable species (Tiwari *et al*., 2018; Choudhury *et al*., 2019; Prasad *et al*., 2021; Thomas *etal*., 2021). To assess ethnobotanical relevance, Use Value (UV) and Informant Consensus Factor (ICF) were calculated. UV highlighted the most culturally important species, while ICF revealed high consensus on plants used for digestive, respiratory, and inflammatory ailments, demonstrating strong community agreement and established traditional practice.

The application of quantitative indices revealed insightful patterns regarding the cultural salience and therapeutic relevance of *Zingiberaceae* species in the Kaina Hill Range. The Use Value (UV) index highlighted the species most frequently reported by informants. The highest UV was recorded for *Zingiber officinale* (UV = 1.52), followed closely by *Curcuma longa* (UV = 1.44) and *Kaempferia galanga* (UV = 1.30). These species are integral to local healthcare systems due to their broad therapeutic applications, particularly in the treatment of digestive, respiratory, and inflammatory conditions. The high UV values suggest that these plants are not only widely known and used, but also hold central roles in traditional medical practices. In contrast, species such as *Hedychium flavum* and *Alpinia nigra* had lower UV values (0.64 and 0.72, respectively), which may indicate more specialized applications or a gradual decline in their cultural transmission.

Similarly, the Informant Consensus Factor (ICF) values reflect the degree of agreement among informants regarding plant usage for specific ailments. The highest ICF was observed for inflammatory conditions (ICF = 0.925), demonstrating strong consensus and well-established traditional knowledge in this category. Digestive disorders (ICF = 0.921) and respiratory ailments (ICF = 0.912) also showed high levels of agreement, highlighting them as prevalent and consistently treated health concerns within the community. A moderate ICF was observed for skin conditions (0.895), indicating a relatively wider variety of treatment approaches. Collectively, these results indicate that species with high UV and ailment categories with high ICF are deeply embedded in indigenous knowledge systems and may possess bioactive constituents of pharmacological interest. The convergence of high UV and ICF values reinforces their importance in traditional healing and underscores the potential for further scientific validation and bioprospecting.

This study highlights the rich ethno-pharmacological knowledge associated with *Zingiberaceae* species in the Kaina Hill Range of Imphal East, Manipur. The documentation of 25 medicinal species, alongside their vernacular names, preparation methods, and therapeutic applications, underscores the deep-rooted reliance of local communities on traditional plant-based healthcare systems. The high Use Value (UV) of species like *Zingiber officinale*, *Curcuma longa*, and *Kaempferia galanga*, and the strong Informant Consensus Factor (ICF) for ailments such as inflammation, digestive disorders, and respiratory conditions, reflect both the cultural significance and pharmacological potential of these plants. The predominance of rhizomes in traditional remedies, sustainable harvesting practices, and diverse preparation techniques suggest a refined, empirical knowledge base rooted in centuries of experience. The seasonal availability of medicinal plants corresponding to disease incidence patterns reveals an ecological intelligence embedded within indigenous knowledge systems. Furthermore, the convergence of ethnobotanical uses with modern pharmacological validation affirms the scientific merit of traditional practices. However, the vulnerability and data-deficient status of several key species raise conservation concerns. Immediate steps are required to integrate traditional ecological knowledge with in-situ and ex-situ conservation strategies, supported by policy and community engagement. Overall, this research not only documents a significant biocultural heritage but also opens avenues for phytochemical studies, value-added product development, and sustainable biodiversity utilization in the Indo-Burma biodiversity hotspot.

Table 1. Ethnobotanical quantitative indices of use value (UV) of key medicinal plants

Sl. No.	Scientific name	Local name	Total Use Reports (∑U)	No. of Informants (N)	Use Value (UV)
1	*Zingiber officinale*	Shing	76	50	1.52
2	*Curcuma longa*	Yaingang	72	50	1.44
3	*Kaempferia galanga*	Leibak lei	65	50	1.30
4	*Amomum aromaticum*	Namra	55	50	1.10
5	*Curcuma caesia*	Yaimu	50	50	1.00
6	*Alpinia galanga*	Kanghoo	48	50	0.96
7	*Hedychium spicatum*	Takhellei hangampal	42	50	0.84
8	*Curcuma aromatica*	Lam yaingang	38	50	0.76
9	*Alpinia nigra*	Pullei	36	50	0.72
10	*Hedychium flavum*	Loklei	32	50	0.64

Table 2. Ethno-botanical quantitative indices of informant consensus factor (ICF) by ailment category

Sl. No.	**Ailment category**	**Number of use reports(Nur)**	**Number of species (Nt)**	**ICFValue**
1	Digestive Disorders	115	10	0.921
2	Respiratory ailments	92	9	0.912
3	Liver disorders	81	8	0.912
4	Skin conditions	58	7	0.895
5	Inflammatory conditions	68	6	0.925

Table 3. Ethno-medicinal and ecological data of *Zingeberaceae* species

Sl. No	Scientificname	Sanskrit name	Localname	Mode of administration	Preparationmethod	Habitat and Distribution	Partused	Medicinal uses	Phenology	Conservation status
1	*Alpinia galanga* (L.) Willd.	Rasna	Kanghoo	Oral, topical	Boiled in water or crushed fresh	Moist valleys	Rh, fl	Respiratory aid, anti - microbial	Aug. – Dec.	Least Concern
2	*Alpinia nigra* (Gaertn.) Benth.	Takara	Pullei	Oral	Rhizome boiled and taken as tea or used in food	Shaded forests	Rh	Digestive, stimulant	July – Oct.	Least Concern
3	*Alpinia officinarum* Hance	Malaya	Pulleimanbi	Oral	Dried rhizome powdered or decocted	Garden plots	Rh	Antioxidant, anti - inflammatory	Aug. – Nov.	Least Concern
4	*Alpinia zerumbet* Benth. & R.M. Smith	Mahabharivacha	Light galangal	Oral, topical	Leaves boiled for tea; rhizome paste	Moist subtropics	Rh, lvs	Antihypertensive, antimicrobial	July – Oct.	Least Concern
5	*Amomum aromaticum* Roxb.	Ghritachi	Namra	Oral	Seeds chewed or powdered	Lowland forests	Sh, sd, rh	Digestive, anti-flatulent	Aug. – Oct.	Least Concern
6	*Curcuma amada* Roxb.	Amragandha	Yaiheinouman	Oral, topical	Fresh rhizome ground or eaten	Gardens, wild patches	Rh	Cooling, carminative	July – Oct.	Least Concern
7	*Curcuma angustifolia* Roxb.	Tavakshira	Yaipal	Oral	Rhizome dried, powdered	Moist sandy soils	Rh	Nutritional, demulcent	July – Oct.	Least Concern
8	*Curcuma aromatic* Salisb.	Vanaharidra	Lam yaingang	Topical	Ground into paste	Wild, home gardens	Rh	Skin care, antioxidant	July – Nov.	Least Concern
9	*Curcuma caesia* Roxb.	Haridra	Yaimu	Oral, topical	Crushed fresh or boiled	Wild in forests	Rh	Anti-inflammatory, wound healing	July – Nov.	Vulnerable
10	*Curcuma* longa (L.)	Haladi	Yaingang	Oral, topical	Dried, powdered or boiled	Widely cultivated	Rh	Antioxidant, antimicrobial, hepatoprotective	June – Oct.	Least Concern
11	*Curcuma zedoaria* Roscoe.	Karchoora	Yaingangangouba	Oral	Fresh rhizome consumed or boiled	Rare in wild	Rh	Antimicrobial, digestive stimulant	Aug. – Oct.	Data Deficient
12	*Costus speciosus* (Koenig) Sm.	Kushta	Khongbantakhellei	Oral, topical	Crushed leaves and rhizome	Moist slopes	Rh, lvs	Diuretic, antidiabetic	July – Oct.	Least Concern

13	*Elettaria cardamomum* (L.) Maton. (Cult.)	Ela	Elaichi	Oral	Seeds infused or ground	Cultivated	Sd	Carminative, breath freshener	Aug. – Nov.	Least Concern
14	*Hedychium auranacum* (L.)	Shati	Engen lei	Topical, oral	Flowers boiled; rhizome pounded	Forest edges	Fl, rh	Aromatic, expectorant	Aug. – Oct.	Least Concern
15	*Hedychium coronarium* J. Koenig	KalyanaSaughandhikam	Takhellei	Topical	Pounded into paste	Moist areas, stream sides	Rh, sh	Antioxidant, asthma relief	Aug. – Oct.	Least Concern
16	*Hedychium flavum* Roxb.	GandhaShatika	Loklei	Oral	Boiled rhizome	Forest fringes	Rh, sh	Liver tonic, anti - inflammatory	July – Oct.	Near Threatened
17	*Hedychium marginatum* C.B. Clarke	Gandhamulika	Takhelleiangangba	Topical	Fresh rhizome ground	Hill slopes	Rh	Wound healing, anti - inflammatory	Aug. – Oct.	Data Deficient
18	*Hedychium spicatum* Buch. – Ham.	Karchura	Takhelleihangampal	Oral	Boiled and consumed	Forest undergrowth	Rh	Bronchodilator, febrifuge	Aug. – Oct.	Vulnerable
19	*Kaempferia galanga* (L.)	Chandramoolika	Leibak lei	Oral, topical	Pounded or boiled	Moist deciduous forest	Rh	Asthma relief, antimicrobial	Aug. – Oct.	Vulnerable
20	*Kaempferia parviflora* Wall. ex Baker	Kachooram	Shingamuba	Oral	Capsule formulation	Rarely cultivated	Rh	Aphrodisiac, antioxidant	Aug. – Nov.	Data Deficient
21	*Kaempferia rotunda* (L.)	Bhuchampaka	Yaithamnamanbi	Oral, topical	Boiled or applied	Hill slopes	Rh	Antioxidant, skin tonic	Aug. – Oct.	Data Deficient
22	*Kaempferia angustifolia* Roscoe.	Chandramuli	Peacock ginger	Oral, topical	Pounded rhizome	Hills, gardens	Rh	Digestive, skin ailments	Aug. – Oct.	Data Deficient
23	*Zingiber cassumunar* Roxb.	Vanardraka	Tekhaoyaikhu	Topical, oral	Extracted oil or boiled	Shaded woodlands	Rh	Anti-inflammatory, analgesic	July – Oct.	Vulnerable
24	*Zingibe rofficinale* Roscoe.	Ardrakam	Shing	Oral	Boiled, raw or paste	Widely cultivated	Rh	Anti-inflammatory, digestive, antiemetic	July – Dec.	Least Concern
25	*Zingiber zerumbet* Roscoe. ex Sm.	Karpura-harida	Shingkhang	Oral, topical	Crushed and infused	Moist forests	Rh	Anti-ulcer, anti-inflammatory	Aug. – Nov.	Vulnerable

Abbreviations: **Lvs** = Leaves; **Rh** = Rhizome; **Fl**= Flowers; **Sd** = Seeds; **Sh** =Sho

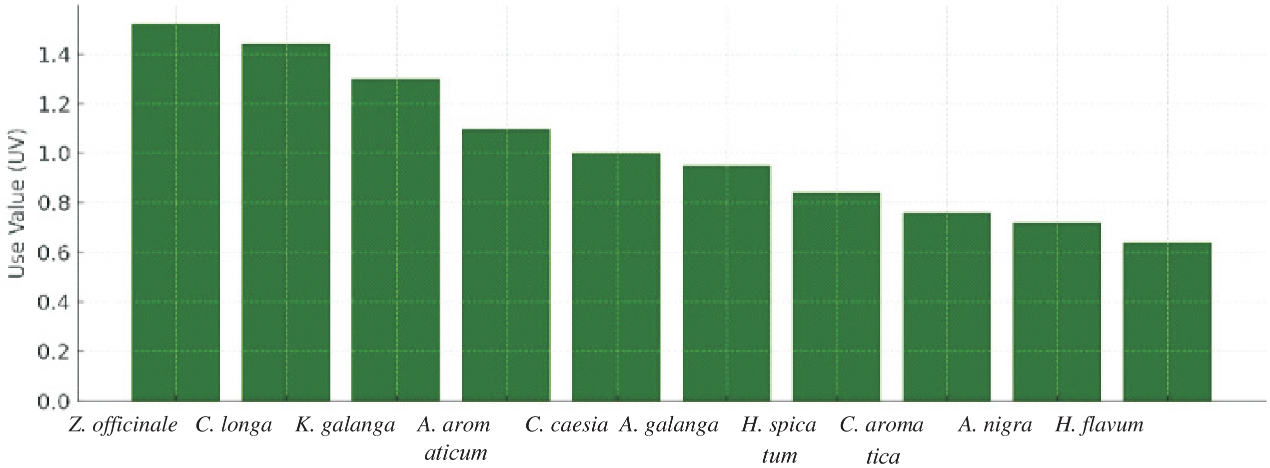

Fig. 1. Use value (UV) of top 10 Zingiberaceae species

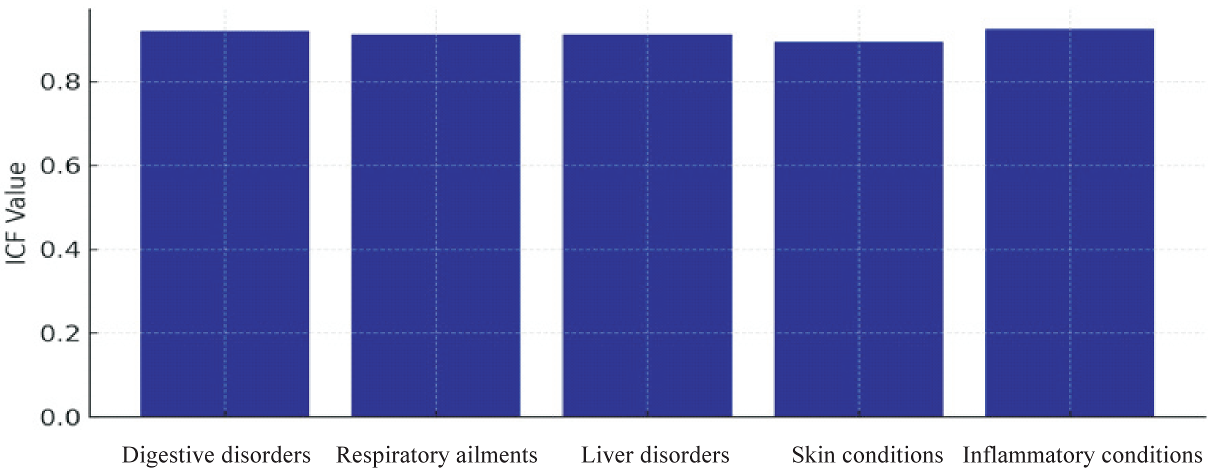

Figure 2. Informant consensus factor (ICF) by ailment category

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