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Assessment of ethno botanical values of important wild edible fruiting species: *Semecarpus anacardium* L. and *Flacourtia indica* (Burm.f.) Merr. in Central India

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Abstract

This study examines the ethnobotanical and ethnomedicinal values of two significant wild edible fruiting species, *Semecarpus anacardium* L. and *Flacourtia indica* (Burm.f.) Merr., in Central India. These species, utilized in 33 ethnobotanical categories by surveyed households, demonstrate diverse practical applications and cultural importance. *Flacourtia indica* boasts 24 notable uses, including 20 medicinal and 4 sociocultural, while *Semecarpus anacardium* exhibits 17 uses, with 13 medicinal and 4 sociocultural. The total use reports (URs) for these species reached 462, with *Flacourtia indica* accounting for 252 URs and *Semecarpus anacardium* for 210 URs. The use value (UV) indicates higher significance for *Flacourtia indica* (1.909) compared to *Semecarpus anacardium* (1.591). Furthermore, *Semecarpus anacardium* showed a marginally higher frequency of citation (FCs) at 91 versus *Flacourtia indica*'s 90, and a relative frequency of citation (RFCs) of 0.689 compared to 0.682. Relative importance (RIs) and cultural value (CVe) metrics further highlight *Flacourtia indica*'s prominence with an RI of 0.995 and a CVe of 0.947, compared to *Semecarpus anacardium*'s RI of 0.854 and CVe of 0.565. Fidelity levels (FLs) reveal significant local confidence in both species for treating various ailments, with *Semecarpus anacardium* showing high efficacy for conditions like cough and cold and ringworm infestation, and *Flacourtia indica* for fever. The study underscores the urgent need for conservation efforts due to reported population declines driven by factors such as developmental activities, agricultural expansion, overharvesting, and climate change. Integrating ethnobotanical knowledge into conservation strategies is crucial for preserving biodiversity and cultural heritage. Further interdisciplinary research is recommended to validate the medicinal properties and explore sustainable resource management practices.

Keywords: Ethnobotany, ethnomedicine, wild edible fruits, *Semecarpus anacardium*, *Flacourtia indica*, Central India

Introduction

The World Health Organization (WHO) acknowledges that herbal medicines address the healthcare needs of approximately 80% of the global population, particularly those residing in rural areas of developing nations (WHO, Year). India, with an illustrious tradition spanning over 5000 years of plant-based medicines, stands as a repository of rich traditional knowledge regarding medicinal plants. Ancient medical systems in India, such as Ayurveda, Siddha, Sowa Rigpa (Amchi), and Unani, are well-documented and supported by compelling evidence demonstrating their efficacy (Sen & Chakraborty, 2016) [25]. Folk medicine also plays a crucial role in India, particularly in remote rural areas, where an estimated 8000 plant species are used. Local folk medicine practitioners in India employ nearly 25,000 effective plant-based formulations, although these practices are not formally codified (Sen & Chakraborty, 2016) [25]. This tradition has culminated in the Ayurvedic system of medicine, predominantly reliant on native plants to provide accessible and cost-effective healthcare solutions.

Ethnobotanical studies play a pivotal role in modern drug development and treatments by meticulously documenting the medicinal uses of plants and promoting plant conservation (Calzada & Bautista, 2020) [3]. Central India, nestled in the heart of India, is home to a diverse population, particularly tribal communities belonging to various ethnic groups. Most of the tribal regions in central India are characterized by rugged terrain, dense forests, and a long history of habitation on hilltops and foothills, spanning several centuries (Saxena, 1988; Rai *et al*., 2002, 2003, 2004a, 2004b) [23, 18, 19, 20, 21]. It boasts a rich tapestry of indigenous tribes, including the Baiga, Bhariya, Korku, Korwa, Sahariya, Kol, Bhil, Gond, Pao, Khairwar, Maria, Kamar, and more, each with its unique resource utilization practices and ecological insights. These communities possess extensive knowledge about different plant species, accumulated over generations through observations passed down through the ages. They rely on various formulations crafted from different parts of plants to address health issues in their primary healthcare practices. Given their distinct environments and traditions, preserving and documenting their knowledge about plant resources, especially wild edible fruits, is of utmost importance. Among these, Semecarpus anacardium and *Flacourtia indica* are notable for their wide range of uses by local communities. Understanding their traditional applications can provide insights into potential modern medical uses and support conservation efforts. This research paper aims to delve into the ethnobotanical significance of wild edible fruits among

tribal communities in central India. It explores the nutritional and medicinal potential of these fruits, their role in supplementing diets, and their significance in supporting the livelihoods of tribal populations. Additionally, the paper underscores the importance of promoting the wider and continued acceptance of wild fruits as essential elements of the diet, especially in the context of an expanding population and changing food preferences. Understanding the value of these fruits is not only a matter of preserving cultural heritage but also holds the key to addressing contemporary issues of food insecurity and malnutrition among tribal communities. This knowledge pertains to the treatment of a wide array of ailments and diseases. To achieve these objectives, we gathered and quantitatively analyzed ethnobotanical data using various indices.

Methodology

Study Area: The study was conducted in Central India (Madhya Pradesh, Maharashtra, and Chhattisgarh), encompassing diverse tribal communities known for their rich traditional knowledge of medicinal plants through field expeditions in different forest divisions and adjacent villages over three years, from 2021 to 2024. The tribal communities studied include the Baiga, Bhariya, Korku, Korwa, Sahariya, Kol, Bhil, Gond, Pao, Khairwar, Maria, Kamar, among others, each contributing unique insights into resource utilization practices.

Ethnobotanical Data Collection: Ethnobotanical data were gathered through structured interviews and participatory observations conducted among selected tribal households/ individuals. The selection criteria included communities known for their reliance on and knowledge of wild edible fruiting species, particularly Semecarpus anacardium and *Flacourtia indica*. The interviews were conducted using a semi-structured questionnaire designed to capture information on the traditional uses, preparation methods, and medicinal applications of these species.

Sampling and Sample Size: A purposive sampling method was employed to select informants based on their expertise in traditional knowledge of medicinal plants. The sample size comprised households// individuals representing different tribal groups across the study area. Informants included traditional healers, elderly community members knowledgeable about local flora, and individuals recognized for their expertise in traditional medicine practices. Information regarding the factors contributing to the decline of Semecarpus anacardium and *Flacourtia indica* in their natural habitats was also gathered from the informants.

Data Analysis: Quantitative data analysis included calculating indices such as Use Value (UV), Relative Importance (RI), Informant Consensus Factor (ICF), and Fidelity Level (FL) to determine the significance and consensus of reported plant uses. UV was calculated to assess the relative importance of Semecarpus anacardium and *Flacourtia indica* based on the frequency of citation of their uses across informants. RI was computed to evaluate the overall importance of each species within the local pharmacopeia, while ICF provided insights into the consensus among informants regarding specific medicinal uses. FLs were determined to gauge the reliability and effectiveness of reported medicinal uses based on the percentage of informants citing specific use categories.

Results

Socio-demographic information of informants: a total of 400 informants were participated in this study. The Sociodemographic information given in the table below: -

Table 1: Socio-demographic variables of Informants (n = 400) in Central India.

Factor	Classes	Frequency	Percentage %
Gender	Female	39	9.75
	Male	361	90.25
Age	<30	105	26.25
	31-40	107	26.75
	41-50	86	21.50
	>51	102	25.50
Educational status	Illiterate	162	40.50
	Primary	20	5.00
	Secondary	186	46.50
	University	32	8.00

Number of Uses

These species were utilized in 33 ethnobotanical categories by surveyed households. *Flacourtia indica*, with 20 medicinal and 4 sociocultural uses, and Semecarpus anacardium, with 13 medicinal and 4 sociocultural uses, are particularly notable. These species are utility and significant within their respective ecosystems or cultural contexts. *Flacourtia indica*, with 24 NUs, shows a diverse range of practical applications and cultural uses, contributing to its value and importance. These could include medicinal properties, culinary uses, or ecological benefits, indicating its multifaceted role in local communities. Similarly, Semecarpus anacardium, with 17 NUs, also demonstrates its recognized utility and cultural relevance, albeit slightly fewer than *Flacourtia indica*.

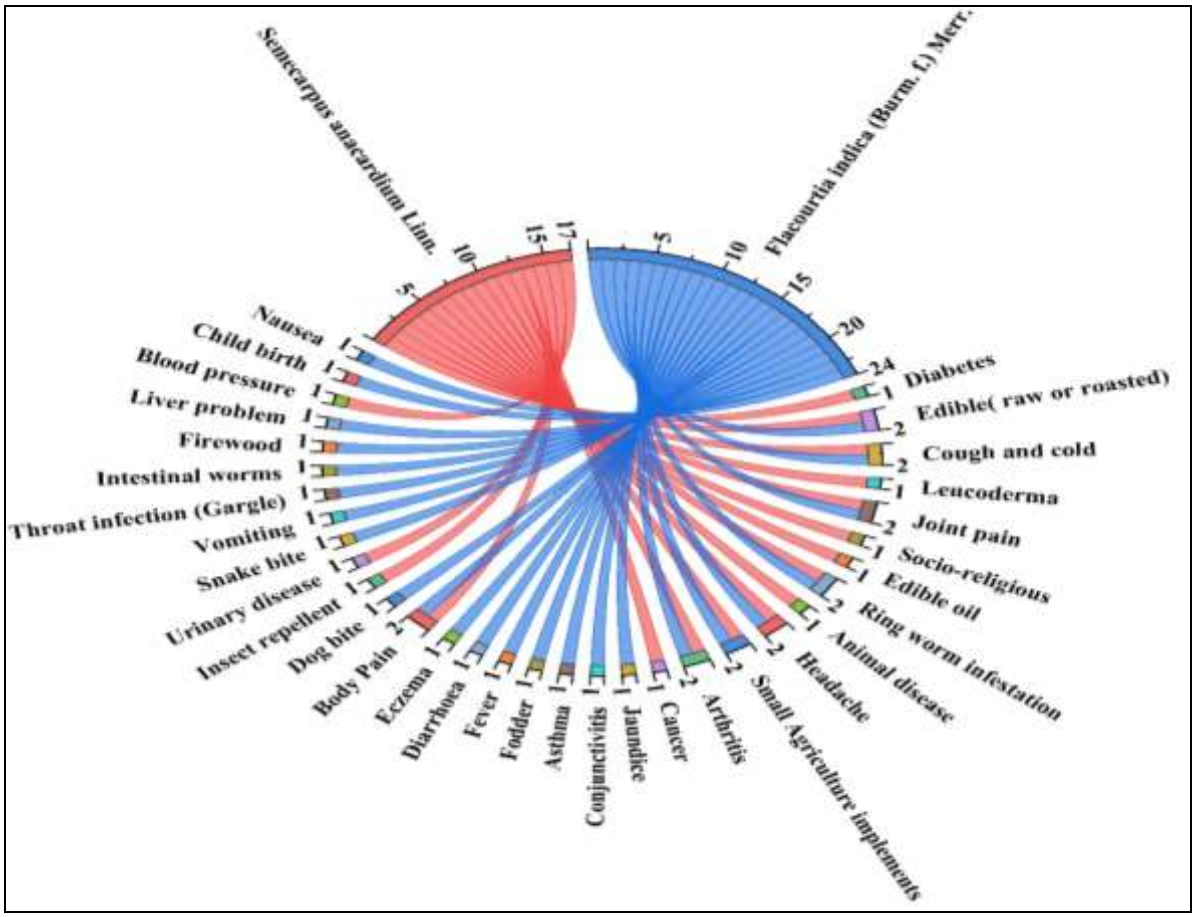


Fig 1: Species used in various ailment categories

Use Reports (URs)

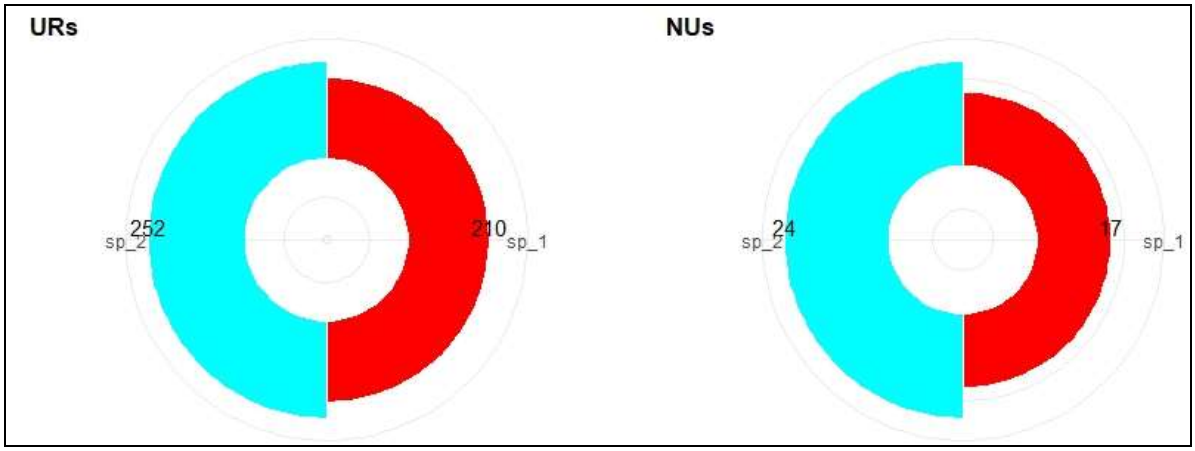
The total use reports for both species are 462. *Flacourtia indica*, with 252 URs, demonstrates its widespread use and value across different communities and regions. This suggests its versatility and potential applications, such as medicinal, culinary, or ritualistic uses. Similarly, Semecarpus anacardium, with 210 URs, also reflects its significant importance, although slightly fewer than *Flacourtia indica*.

Use value (UV)

The use value (UV) data for *Flacourtia indica* and *Semecarpus anacardium* indicate their respective importance and prevalence in local contexts. *Flacourtia indica*, with a UV of 1.909, suggests it holds higher significance based on reported uses compared to *Semecarpus anacardium*, with a UV of 1.591. This metric not only considers the number of reported uses but also factors in the cultural, economic, and ecological roles these species play within their habitats.

Frequency of citation (FCs)

The frequency of citation (FCs) data for *Semecarpus anacardium* and *Flacourtia indica* indicates how often these species are referenced or cited in various contexts. *Semecarpus anacardium* has an FCs of 91, slightly higher than *Flacourtia indica*'s FCs of 90. This suggests that *Semecarpus anacardium* may be marginally more frequently mentioned by users compared to *Flacourtia indica*.



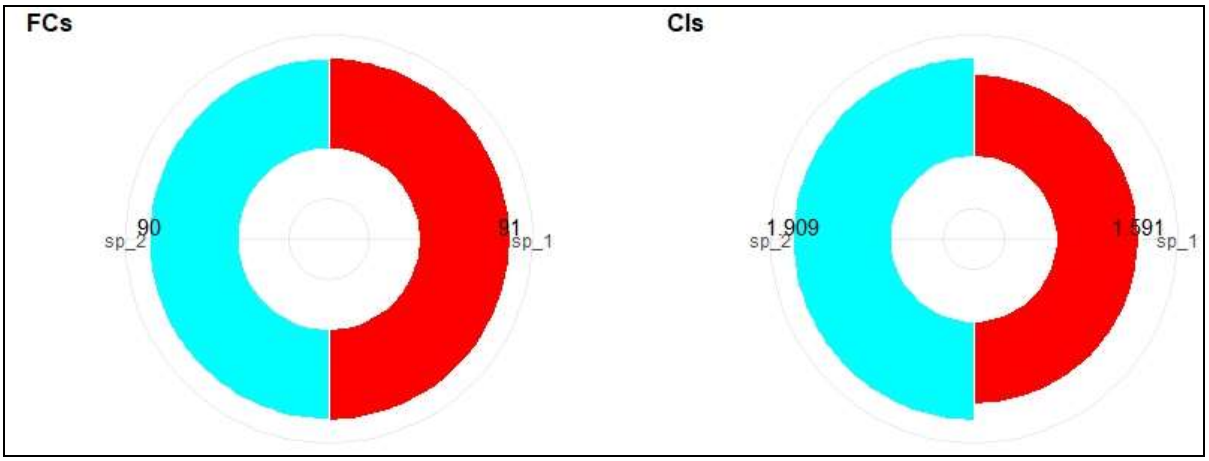


Fig 2: Cow Plot URs, Nus, FCs, and CIs

Relative Frequency of Citation (RFCs)

The data on Relative Frequency of Citation (RFCs) for *Semecarpus anacardium* and *Flacourtia indica* provides information on how often they are cited in literature or research. *Semecarpus anacardium* has an RFCs of 0.689, slightly higher than *Flacourtia indica* RFCs of 0.682. This suggests that *Semecarpus anacardium* is cited slightly more frequently relative to the number of documents or studies available compared to *Flacourtia indica*.

Relative Importance Index

The Relative Importance (RIs) values for *Flacourtia indica* and *Semecarpus anacardium* indicate their comparative importance within a specific context. *Flacourtia indica* has an RI of 0.995, suggesting it is considered slightly more important relative to *Semecarpus anacardium*, which has an RI of 0.854. This metric reflects a comparative assessment of importance, possibly in terms of ecological significance, economic value, cultural relevance, or other criteria relevant to their roles within their ecosystems or human interactions.

FLs (Fidelity Level)

A total of 27 categories of ailments have been recorded, in which both species are used. Semecarpus anacardium is used to treat 13 different categories of medicinal conditions, while Flacourtia is used for 20 categories. The fidelity level varies from 2.30% to 28.74% for different categories of ailments. For *Flacourtia indica*, it varies from 2.27% to 20.45%. There are six common ailments in which both species were used to treat: arthritis, body pain, cough and cold, headache, joint pain, and ringworm infestation. In the case of ringworm infestation, Semecarpus anacardium has a significantly higher fidelity level (28.74%) compared to *Flacourtia indica* (11.36%). For headache, *Flacourtia indica* has a higher fidelity level of 18.18% compared to Semecarpus anacardium's 5.75%. In the case of cough and cold, Semecarpus has a higher fidelity level of 28.74% compared to *Flacourtia indica* 15.91%. For body pain, *Flacourtia indica* has a higher fidelity level of 11.36% compared to Semecarpus anacardium's 9.2%. In the case of joint pain, Semecarpus anacardium has a higher fidelity level of 25.29% compared to *Flacourtia indica* 9.09%. Lastly, for arthritis, *Flacourtia indica* has a higher fidelity level of 10.23% compared to Semecarpus anacardium 3.45%, suggesting a stronger belief in its efficacy for this condition among the surveyed users. The highest fidelity level for *Flacourtia indica* was observed for fever at 25.0%, while the lowest was 2.027% for conjunctivitis. For Semecarpus anacardium, the highest fidelity level was 28.74% for cough and cold, and ringworm infestation, while the lowest was 2.30% for urinary disease and cancer.

Cultural Value (CVe) for ethnospecies

The Cultural Value (CVe) data for *Flacourtia indica* and *Semecarpus anacardium* provide insight into their perceived significance within cultural frameworks. *Flacourtia indica* has a CVe of 0.947, indicating it holds a higher cultural value compared to *Semecarpus anacardium*, which has a CVe of 0.565. This metric reflects the species' importance in traditional knowledge systems, rituals, folklore, or other cultural practices. *Flacourtia indica*'s higher CVe suggests it plays a more substantial role in local cultures, possibly due to its broader range of uses, deeper historical connections, or stronger symbolic meanings. *Semecarpus anacardium*, while still culturally valued, has a lower CVe, indicating it may have a narrower cultural significance. Both species contribute to the cultural diversity and heritage of their respective regions or communities, albeit to varying extents.

Reduction in the population of wild edible fruit species

The decline of *Semecarpus anacardium* and *Flacourtia indica* in the wild is influenced by a range of human and natural factors. Developmental activities (43 responses) and agricultural expansion (42 responses) are the leading causes, followed by overharvesting (39 responses), overgrazing (38 responses), and forest area reduction (35 responses). Fire (34 responses), seed dormancy (20 responses), invasive alien species (18 responses), and low/poor germination (26 responses) also contribute to their dwindling numbers, with climate change (17 responses) being the least reported factor. This comprehensive feedback from 132 users highlights the urgent need for conservation efforts to mitigate these threats.

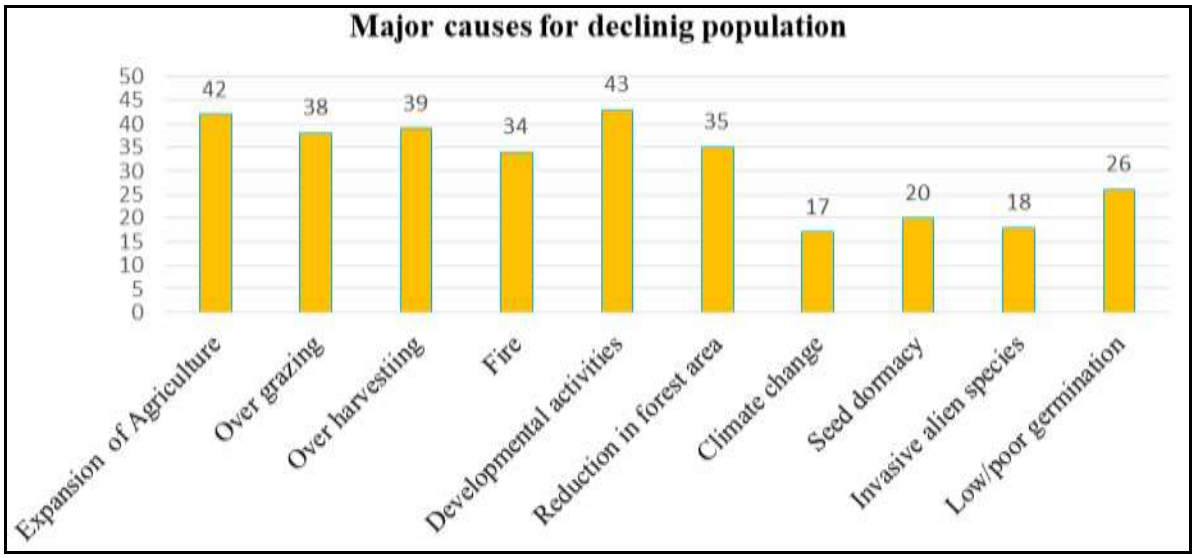


Fig 3: Response behaviour of users for reduction in wild population

Discussion

Flacourtia indica has a wide range of uses, with 24 documented applications across 33 ethnobotanical categories. These include medicinal uses (20) such as treating arthritis, asthma, body pain, childbirth, conjunctivitis, cough and cold, diarrhea, dog bites, eczema, fever, headache, intestinal worms, jaundice, joint pain, liver problems, nausea, ringworm infestation, snake bites, throat infections (gargling), and vomiting. There are also sociocultural uses (4) such as wild food, small agriculture implements, fodder, and firewood.

Similar findings have been reported for the use of Traditional Medicine in various conditions including Asthma, Cough, Fevers, Dysentery, Intestinal Worms, Diarrhoea (Lim, 2013; Tiwari, R., *et al*. (2017)) [12, 29], Jaundice (Akinnifesi *et al*., 2008; Franzel *et al*., 2008; Amritha and Santhosh, 2021; Eramma and Gayathri, 2013; Kirtikar and Basu, 2002; Nazneen, M. Z., *et al*., 2002) [1, 7, 2, 6, 9, 14], and Snakebite (Lim, 2013; Eramma *et al*., 2016) [12, 5].

In contrast, Semecarpus anacardium, while also valued, presents 17 documented uses across similar categories, focusing primarily on medicinal (13) such as Animal disease, Arthritis, Blood pressure, Body Pain, Cancer, Cough and cold, Diabetes, Headache, Insect repellent, Joint pain, Leucoderma, Ring worm infestation and urinary diseases rather than sociocultural (4) applications such as Socio-religious, wild food and Small Agriculture implements.

Previous studies have reported similar findings, indicating that different part of semecarpus anacardium has anti-inflammatory, analgesic, anti-arthritic, antitussive properties (Krantikumar and Atul, 2015; Krithikar and Basu, 1975; Semalty *et al*., 2010; Premalatha and Sachdanandam, 2000) [10, 11, 24, 17]. It has also been found to have properties related to diabetes and urinary diseases (Pandey and Chunekar, 1967; Thakur and Puri, 1978; Gouthaman *et al*., 2008) [15, 28, 8], hepatoprotective effects (Vad, 1973; Krantikumar and Atul, 2015) [30, 10], and anticancer properties (Patwardan *et al*., 1988; Vad and Kulkarni, 1975; Smit *et al*., 1995; Krantikumar and Atul, 2015; Gouthaman *et al*., 2008) [16, 10, 26, 10, 8]. Additionally, it possesses anthelmintic properties (Premalatha and Sachdanandam, 2000) [17].

Semecarpus anacardium slightly outperforms *Flacourtia indica* in terms of FCs (91 vs. 90) and RFCs (0.689 vs. 0.682), indicating that it has received slightly more attention and documentation in the available literature. On the other hand, *Flacourtia indica* has a higher relative importance index (RI) of 0.995 compared to Semecarpus anacardium's 0.854, suggesting that it is more widely recognized and perceived as significant across ecological, economic, and cultural criteria. *Flacourtia indica* also has a higher CVe (0.947) compared to Semecarpus anacardium (0.565), indicating that it is more deeply embedded in the local culture and has a wider range of cultural uses. This suggests that *Flacourtia indica* plays a more significant role in shaping local cultural practices and identities, possibly due to its versatile applications and historical symbolism.

When it comes to efficacy beliefs for specific medicinal categories, fidelity levels (FLs) are of importance. *Flacourtia indica* shows notable fidelity levels for various ailments, particularly high for fever (25.0%) and moderate for conditions like arthritis and snake bites. In contrast, Semecarpus anacardium exhibits remarkable fidelity in treating ailments such as cough and cold (28.74%) and ringworm infestation (28.74%), indicating strong local confidence in its therapeutic effectiveness for these conditions. These differences highlight the nuanced roles and perceived effectiveness of each species within local healthcare traditions.

Conclusion

Based on the comprehensive ethnobotanical analysis of *Flacourtia indica* and Semecarpus anacardium, several key insights emerge regarding their cultural significance and ecological roles. *Flacourtia indica* exhibits higher citation frequencies and a greater relative importance index compared to Semecarpus anacardium, indicating broader recognition and perceived significance within scientific and cultural contexts. Conversely, Semecarpus anacardium, while slightly less cited and culturally valued based on lower cultural value index, showcases strong fidelity levels in treating specific ailments such as cough and cold and ringworm infestation, suggesting deep-rooted local confidence in its medicinal efficacy. Both species contribute

significantly to local healthcare traditions and ecological interactions, underscoring the importance of integrating ethnobotanical knowledge into conservation efforts aimed at preserving biodiversity and cultural heritage in diverse ecosystems. Further interdisciplinary research is warranted to explore the biochemical basis of their medicinal properties and validate their roles in sustainable resource management practices.

Recommendations for Further Research

Phytochemical Studies: Detailed analyses to isolate and identify bioactive compounds.

Clinical Trials: Rigorous testing to validate traditional medicinal claims.

Sustainable Use: Developing sustainable harvesting and cultivation practices to ensure the conservation of these species.

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Considerations

The study adhered to ethical guidelines, obtaining informed consent from all participants prior to data collection. Confidentiality of information and respect for traditional knowledge were strictly maintained throughout the study process.

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