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Ethnomedicinal survey of the Paliyar tribe: a case study of Kadamalaikundu, Theni District

C. Divya[1,2] · Monalisa Paul[2] · Charu Lata[2] · G. Manikandan[3,4] · R. Ramasubbu[5]

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Abstract

The Paliyar tribe of Kadamalaikundu, Theni District of Tamil Nadu, India, has been deeply associated with forestry and ethnomedicinal practices for ages. The study aimed to identify the important medicinal plant species used by this tribe for ethnomedicinal purposes in the local vicinity. Eighty-nine informants were interviewed using the 'specimen display' and forest walk method, semi-structured open-ended questionnaires, interviews, and personal observations. The people from the region reported ninety-three plant species having medicinal properties. The Solanaceae family was recorded as the most dominant plant family, reporting seven different species of medicinal plants, followed by six species of the Acanthaceae family. In the study, *Coccinia grandis* had the highest use value (2.5), followed by *Withania somnifera* (2). In contrast, *Cardiospermum halicacabum*, *Gossypium hirsutum*, and *Ocimum tenuiflorum* with use value (1) and the ICF (Informant Consensus Factor) of value 1 accounted for 15 diseases out of forty-one categorized ailments. This study confirmed that the Paliyar tribe was dependent on a large number of medicinal plants for their primary healthcare and veterinary well-being, which require immediate conservation owing to their population fragmentation and the reluctance of the younger generation to adopt ethnomedicinal practices as occupation, which could lead to the loss of traditional knowledge as well. The study also documented the

✉ Charu Lata
charulata@niscpr.res.in

1 Vivekanandha College of Arts and Sciences for Women (Autonomous), Elayampalayam, Thiruchengode, Namakkal 637205, Tamil Nadu, India

2 Traditional Knowledge Division, CSIR-National Institute of Science Communication and Policy Research, 14 Satsang Vihar Marg, New Delhi New Delhi, India

3 Sri Kaliswari College (Autonomous), Sivakasi 626130, Tamil Nadu, India

various important medicinal plant uses that could pave the way to the new pharmacological dimensions for modern wellness programs.

Keywords Ethnomedicinal · Medicinal plants · Paliyar Tribe · Theni District · Traditional knowledge

India is one of the world's wealthiest countries in terms of biodiversity. According to species richness, India is one of the 17th mega-biological countries in the world, home to many tribal people. Their population is about 70–80 million, i.e., about 8.14% of the total population reported in the 2011 census (www.censusindia.gov.in). The Botanical Survey of India reported that Tamil Nadu was the first state to initiate the recording and documentation of ethnobotanical data in the early eighties to provide the preliminary status for critical studies about tribal people and their traditional knowledge (Karthik 2016). In Tamil Nadu, 36 tribal communities, namely, Adiyan, Aranadan, Eravallan, Irular, Kadar, Kammara, Kanikaran, Kanikkar, Kaniyan, Kanyan, Kattunayakan, Malasar, Malayali, Paliyar, Pulayar, Sholiga, Toda and likewise are spread across different districts. The Paliyar community is one of the dominant communities in Theni District. Paliyar tribal people are classified into three categories based on their lifestyles, namely Nomadic (do not build houses), Semi Nomadic (small huts), and Settled (permanent houses). Occupation-wise, many still collect food and non-timber forest products from nearby forest areas (Ignacimuthu et al. 2006). They use primarily local plant-based medicines from cultivated lands or forest areas to cure different disorders across all age groups.

1 Introduction

Medicinal plants have constituted a vital part of the traditional medicine systems (TMS) for several thousand years and continue to do so. Traditional medicines, which have been used since immemorial, use organic products derived from macro and micronutrients, plants, and animals. According to the World Health Organization (www.who.int), 80% of the world's population depends on local or indigenous medicine for their primary healthcare requirements (Mukherjee and Wahile 2006). The global estimate indicates that over 75% of people have to count on traditional medicines derived from medicinal plants as the outlay of modern medicines of allopathic origin is too expensive to afford for an ever-rising economically recessed world. In many countries, traditional knowledge systems or medicines are developed through many trials and errors, and the most important remedies are carefully transferred orally from one generation to another (Pei 2001). Since the beginning of the human healthcare system, plant-based

[4] Present address: Department of Pharmaceutical Sciences, Tshwane University of Technology, Pretoria 0083, South Africa

[5] The Gandhigram Rural Institute (Deemed to be University), Dindigul 624302, Tamil Nadu, India

medicines have contributed to it (Venkataswamy et al. 2010; Lulekal et al. 2013). However, such knowledge may disappear due to lack of consciousness, proper documentation, and gross mismanagement.

Most tribal people have used traditional methods to cure human and animal diseases for generations. The local inhabitants of isolated places use folk knowledge to heal different ailments. Ethnomedicines are widely used among the tribal and aboriginal populations to treat various diseases in humans and animals. For example, "Dongria Kandha," a tribe of the Kandhamal district of Odisha, India, practices consuming 10 species of *Dioscorea* genus (a type of tuber) as food and medicine to cure various ailments (Parida and Sarangi 2021). Traditional Indigenous Knowledge can be efficiently preserved through ethnomedicinal surveys (Idolo et al. 2010; Mahmood et al. 2011). Global awareness about medicinal plants and their traditional uses has escalated in recent decades. Many scientific investigations have been conducted in the Indian peninsula about different tribal communities and their knowledge of ethnomedicine (Swain et al. 2022; Marak and Mathew 2022).

In addition, for the last two decades, several ethnomedicinal studies have been carried out in different states in India. The eastern parts of Rajasthan reported 213 species of medicinal plants belonging to 68 families (Upadhyay et al. 2010). Bankura district of West Bengal documented 25 plants used by the Santal people to formulate 40 ethnomedicinal preparations for curing 27 diseases (Rhaman and Karmakar 2015). There are records of 85 medicinal plants belonging to 49 families against 19 different ailments from Nelliyampathy hills, located in the Palakkad district of Kerala (Vijaykumar et al. 2015). Kathua district of J&K reported 197 plants from 87 families and 174 genera (Rao et al. 2015) for ethnomedicinal properties.). Satpura Hills from central India revealed 52 species of plants belonging to 36 families with 14 new ethnomedicinal uses of plants (Kosalge and Fursule 2009). 121 plant species belonging to 105 genera and 53 families were reported for use as medicine for treating 93 types of ailments from Jasrota hills of the western Himalayas (Singh et al. 2020), and western ghats of Karnataka documented 102 plant species with seven endemic species showing ethnomedicinal properties (Bhat et al. 2014). Sixty beneficial plant species belonging to 38 families, used for local health care needs, including ten veterinary useful species, were reported from the Pakyong subdivision of eastern Sikkim (Tamang et al. 2023). Many diseases or ailment-centric ethnomedicinal studies were done in India, such as snake bites (Upasani et al. 2017), epilepsy (Sharma et al. 2013), and skin diseases. The ethnomedicinal research has not been confined to field studies; serious discussions have also been held at policy-making levels in India.

In a momentous initiative, the World Health Organization (WHO) and the Government of India signed an agreement in 2022 to establish the WHO Global Centre for Traditional Medicine at Jamnagar, Gujarat, India. It will concentrate on building a solid evidence base for policies and standards on traditional medicine practices and products. The WHO Global Centre will help India integrate traditional medicines as appropriate into its health systems and regulate their quality and safety for optimal and sustainable impact. The Gujarat Declaration of the first WHO Global Summit on Traditional Medicine at Gandhinagar, India in August 2023, articulated an action agenda focusing on research and evidence. It is proposed appropriately

using existing and new research, evidence syntheses, and knowledge translation principles. It also recommended capacity strengthening to produce, translate, and use Traditional, Complementary, and Integrative Medicine (TCIM) research and Indigenous Knowledge and supporting the evidence-based integration of TCIM in national health policies and systems based on the highest quality research (WHO report). Ministry of AYUSH, Government of India is already promoting Indian Traditional or Indigenous health care systems like Naturopathy, Ayurveda, Yoga, Unani, and Siddha, which integrate various facets of ethnomedicine. Also, the National Institute of Research in Tribal Health (NIRTH), Jabalpur, Madhya Pradesh, is taking great interest in documenting the ethnobotanical and ethno-veterinary practices of the state tribal people as they are the critical observers of their natural environment and conserving the environment through their cultural-traditional values and customary resource management. Similar attempts have been taken up by the Tribal Research Institutes (TRI), the Indian Council of Medical Research (ICMR), the Botanical Survey of India, the Anthropological Survey of India, and the Ayurvedic Institutions to document tribal medicinal knowledge. The SVASTIK (Scientifically Validated Societal Traditional Knowledge) initiative of CSIR implemented by CSIR-National Institute of Science Communication and Policy Research (NIScPR), New Delhi, is also playing a pivotal role in popularizing Indian traditional knowledge including TSMs and ethnomedicines (Lata and Barman 2021).

Valid and comprehensive data can only reveal and help in policy-making concerning traditional knowledge to be authenticated and documented. The government should make a policy that keeps a view of tribal/traditional knowledge and insights and incorporates them with scientific facts (Singh et al. 2022). Throughout the world, ethnobotany is indispensable for developing healthcare and conservation programs. Proper documentation of ethnobotanical studies, methodical and scientific research of traditional medicinal plants, scientifically guided collection practices of the plant parts, enhancement of local classification systems, proper communication through language, global efforts for the preservation of human cognition, cultural history, and beliefs by maintaining world peace, developing social networks globally and access to information for the creation of database management systems are few concrete steps which could augment the restoration of ethnobotanical knowledge worldwide.

Among ethnobotanical studies in the Paliyar tribe, Duraipandiyan et al. (2006) reported the antibacterial activities of 18 medicinal plants, and Ignacimuthu et al. (2006) gave details of 60 medicinal plants. However, the total number of informants was 12, of which only 4 belonged to the tribe. Shanmugam et al. (2009) accounted for 58 medicinal plants identified by the tribe of Virudhunagar district, and Denisia et al. (2022) gave details of the socio-economic status of the tribe of Kodaikanal region with a backdrop of specific traditional culture. The present study aims to analyze and record orally transmitted knowledge by 89 informants of the Theni District of Tamil Nadu on 93 medicinal plants, which is of great importance compared to the previous studies. Although there is another study by Ignacimuthu et al. (2008) from a similar district with 101 medicinal plants, the number of informants was only 15. Jeyprakash et al. (2011) worked in the same district with mixed tribes, some informants, and medicinal plants. This study adds to the baseline information to the

existing knowledge for more research-based investigations that may lead to the discovery of new plant-based herbal drugs in the coming decades. Therefore, this article is the first study of its kind as it fills the gap for the previous studies.

The objective of this manuscript was thus to collect information on the present status of folk ethno-medicinal knowledge of the Paliyar Tribe in the Theni District of Tamil Nadu.

2 Methodology

2.1 Study area

The study area is Kadamalaikundu, in the foothills of the Megamalai Hills in the Theni District of Tamil Nadu, India. The GPS coordinates for the place are between 900 53'N and 100 22' N and 770 17'E and 770 67'E (Fig. 1). This area is rich in plant biodiversity. The temperature increases from March to July, whereas the rainy season is from July to November. The maximum temperature is 28–30 °C. Due to its location at the base of the Western Ghats and adjacent to Kerala State, the district has a cooler temperature.

2.2 Survey within the community

Field trips were conducted during this study from July 2022 to September 2022 in Theni District, Tamil Nadu. The standard methodology (Jain 1967) used was a structured survey to gather information about ethno-medicinal knowledge from Paliyar tribal people. Different age groups of tribal practitioners (between 18 and 90 years) (Fig. 2) were interviewed about the medicinal uses of 93 plants. The study was based on purposive sampling, depending upon the informant's choice of ethnomedicinal plants for which they were willing to share the information.

The information regarding the usage of medicinal plants and the perceptions of the Paliyar tribal people regarding their use in common diseases were collected through a proper questionnaire (Fig. 3), and in addition to the vernacular names, collected data also documented parts of the plant used, method of preparation, form of usage, and addition of other plants or ingredients. The collected plant species were correctly identified through the flora of Tamil Nadu (Matthew 1983) and confirmed with BSI (Botanical Survey of India, Coimbatore, Tamil Nadu). The specimens were deposited at the Herbarium of Botany Department, Vivekananda College of Arts and Sciences for Women, Thiruchengode, Tamil Nadu. Methodologies like 'Specimen Display' and 'Walking through the Forest' were primarily used to collect data from the natives during the interview. Semi-structured open-ended questionnaires, interviews, and personal observations were used to extract ethnomedicinal information. Prior Informed Consent (PIC) was obtained from the respondents during data collection.

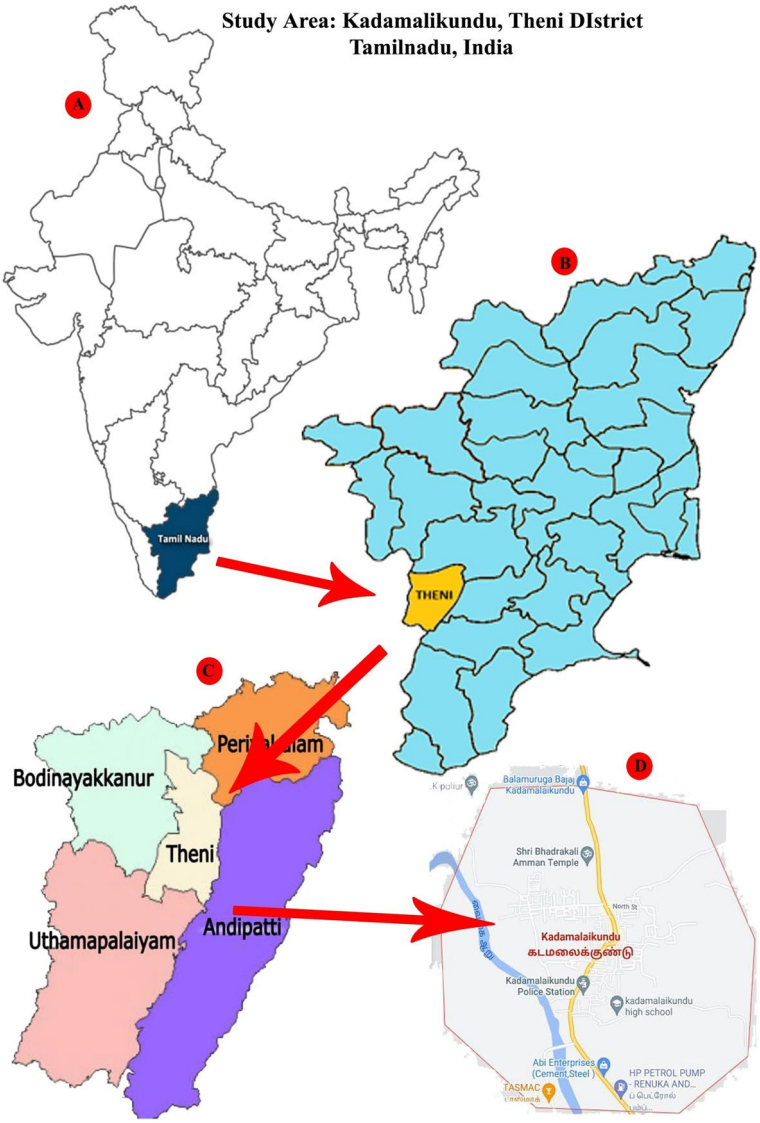

Fig. 1 Map of Theni District

2.3 Data analysis

The indigenous medicinal information of plant species was analyzed using two different techniques:

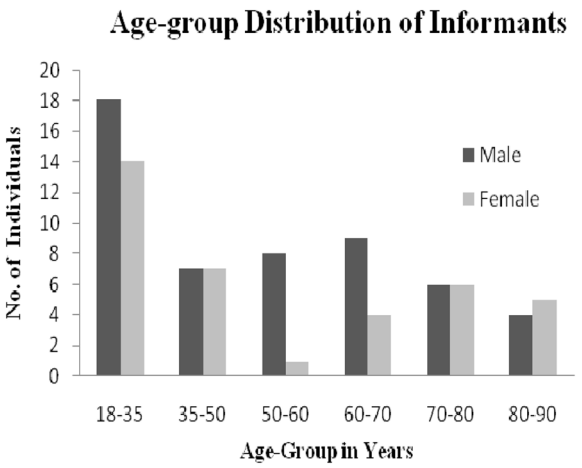

Fig. 2 Age distribution of tribal practitioners

2.3.1 Use value (UV)

The UV is a quantitative method to determine the relative importance of indigenous plant species using the formula: UV = ΣUi /n where Ui represents the sum of the total number of plant parts uses citations by all informants for a given plant species; n is the total number of informants interviewed for a given species (Phillips and Gentry 1993). Use value (UV) is an index widely used to quantify the relative importance of useful plants. It combines the frequency with which a plant species is mentioned with the number of uses mentioned per species and is often used to highlight prominent species of interest (Zenderland et al. 2019).

2.3.2 Informant Consensus Factor (ICF)

ICF was used to indicate the evenness of information. All the mentioned ailments were classified into different groups. The number of citations for every plant claimed to cure that disease was too recorded using the formula: ICF = (Nur-Nt)/(Nur-1), where Nur is the number of plant use reports by the informants for a particular health problem or a number of the use-reports per ailment or plant-use classification. Nt is the number of plant species used for a particular health problem by all the informants, and Nt refers to the number of plant species or taxa reported to address a particular plant-use category. The resulting factor ranges from 0 to 1, where a high value reveals a high rate of informant consensus. Every report of a plant species' use was considered one use-report. ICF values ranged from 0 to 1, where "1" describes the highest level of informant agreement. ICF is a quantitative analytical parameter used to evaluate the degree of agreement among informants' knowledge and is essential in sorting plants for their applicability (Trotter and Logan 1986).

Questionnaires

1) District :
2) Village :
3) Altitude :
4) Place of the Collection :
5) Name of the informants :
6) Age/Sex :
7) The collected specimen is wild or cultivated :
8) Local Name of the plant :
9) Scientific Name and Family :
10) Parts Used :
    - Fresh ☐
    - Dried (Sun, Shade or heat) ☐
    - Powdered ☐
    - Mixture of other herbs or ingredients ☐
11) Method of Preparation :
    - Decotion ☐
    - Juice ☐
    - Paste ☐
12) Mode of Usage :
    - Oral ☐
    - External ☐
    - Infusion ☐
13) Disease used for :
14) Dosage and Age :
15) Other ethano botanical importance :
16) Harvesting or gathering of the plant (Time of the Year) :
17) Belief and superstition :

Signature of Interviewer

Fig. 3 Format of the Survey Form

3 Results

During the scientific investigation, 89 informants were interviewed. Of them, 52 were males and 37 females between 18 and 90 years old. 35.9% of people belonged to the age group of 18–35 years, 15.7% of people belonged to 35–50 years of age group, 10.1% of people belonged to 50–60 years of age, 14.6% of people belonged to 60–70 years of age group, 13.4% of people belonged to 70–80

years of age group and 10.1% of people belonged to 80–90 years of age group. Thus, the highest percentage of informants comprised those between the 18–35 age group. The study included information about 93 plant species belonging to 46 families and 82 genera. These plants were used to treat various diseases in humans and animals. All the plants collected and the methods of preparation of ethnomedicinal formulations were tabulated in Table 1.

The remedies for curing various ailments were documented and classified into 13 types of preparation like decoction, juice, raw, paste, powder, latex, oil, mixture with other plants, cooked form, gel, infusion, and inhaled vapor, which were used externally as well as internally. The 93 plant species reported included 6 climbers, 1 creeping weed, 2 vines, 47 herbs, 10 shrubs, 3 small trees, and 24 tree species (Fig. 4).

Among the collected data, 45 families of plant species have been recorded. Solanacaceae was recorded as a predominant family with 7 species, followed by 6 species in Acanthaceae, 4 species each in the family of Amaranthaceae, Euphorbiaceae, Fabaceae and Lamiaceae, 3 species each in the family of Asteraceae, Combretaceae, Cucurbitaceae, Myrtaceae, Malvaceae and Rutaceae, and 2 species each in the family of Aristolochiae, Asclepiadaceae, Caesalpinaceae, Fabaceae, Convolvulaceae, Leguminosae, Mimosaceae, Pedaliaceae, Rhamnaceae, Verbenaceae and Poaceae. In contrast, a single species was recorded in other families like Acoraceae, Agavaceae, Amaryllidaceae, Apocynaceae, Araceae, Arecaceae, Asparagaceae, Asphodelaceae, Begoniaceae, Cleomaceae, Dioscoreaceae, Flacortiaceae, Hypoxidaceae, Meliaceae, Moraceae, Papavaraceae, Rosaceae, Sapindaceae, Vitaceae and Zygophyllaceae (Fig. 5).

Among the plant parts used by the Paliyar tribals, leaves constituted the major part of ethnomedicine. In some plant species, more than one or two plant parts were used for medicinal purposes. Medicinal plants were displayed and photographed thoroughly (Fig. 6), and the local traditional practitioners interviewed were familiar with the plant species (Fig. 7).

For the use value of different medicinal plants (Table 1), *Coccinia grandis* had the highest use value (2.5), followed by *Withania somnifera* (2), whereas *Cardiospermum halicacabum*, *Gossypium hirsutum* and *Ocimum tenuiflorum* recorded use value (1). With the change in location/area and knowledge of the native people about the use of medicinal plants, the values of UV tend to change. Thus, UV is volatile in nature, and differences in values ought to appear between the cited species and their quantitative value.

The lowest UV was calculated (0.04) for *Asparagus racemosus* and *Tridax procumbens*. In terms of the calculated UV, if a plant receives high values, it indicates its extensive application, high obtainability, extraordinary economic importance, and high perceived efficacy for medicinal purposes. However, it determines whether the plant is referred for a single disease or multiple diseases. High harvesting pressure is associated with high UV-rated medicinal plants; hence, these medicinal plants demand more attention towards their conservation for continued pharmaceutical use and possible future pharmacological studies. This result revealed differences in most cited species and their quantitative value.

Table 1 Ethnomedicinal plants used by Paliyar tribals in Kadamalaikundu, Theni District

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
1.	*Acacia catechu* (L.f.) Willd.	Tree	Mimosaceae	Karungali	Bark	Abortion	Decoction	Orally	0.2
2.	*Albizia lebbeck* (L.) Benth.	Tree	Mimosaceae	Nenmenivaka	Stem	Skin disease	Oil	External application	0.16
3.	*Aloe barbadensis* Miller	Herb	Asphodelaceae	Sottru katrallai	Leaves	Body heat and Skin diseases	Gel	Orally	0.66
4.	*Aegle marmelos* (L.) Correa	Tree	Rutaceae	Vilvam	Leaves	Body heat and eye infection	Powder	Orally	0.25
5.	*Aerva lanata* (L.) A. L. Juss.	Shrub	Amaranthaceae	Sirukan peelai	Leaves	Kidney stone and Leg pain	Fresh juice	Orally and External application	0.5
6.	*Aerva javanica* (Burm.f.) Shult.	Herb	Amaranthaceae	Perum peelai	Flowers and Seeds	Psoriasis (Skin disease)	Paste	External application	0.11
7.	*Amaranthus spinosus* L.	Herb	Amaranthaceae	Mullu keerai	Leaves	Clean stomach	Cooked form	Orally	0.25
8.	*Andrographis paniculata* (Burm.f.) Nees	Herb	Acanthaceae	Nilavembu	Leaves	Skin disease and Poisonous bites	Powder	Orally	0.25
9.	*Argemone maxicana* L.	Herb	Pappavaraceae	Bhrammathandu	Latex	Skin disease	Latex	External application	0.5
10.	*Aristolochia bracteolata* Lam.	Herb	Aristolochiaceae	Aaduthendapaalai	Leaves	stomach problem	Paste	Orally	0.2
11.	*Abutilon indicum* (L.) Sweet	Shrub	Malvaceae	Thuthi	Leaves	Piles disease	Decoction	Orally	0.25

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
12.	*Acalypha indica* L.	Herb	Euphorbiaceae	Kuppaimeni	Leaves	Psoriasis (Skin disease)	Paste	External application	0.22
13.	*Achyranthes aspera* L.	Herb	Amaranthaceae	Nayurivi	Root	Toothache	Juice	Orally	0.11
14.	*Acorus calamus* L.	Herb	Acoraceae	Vasambu	Rhizome	Stomach problem	Dried form	Orally	0.14
15.	*Aristolochia indica* L.	Herb	Aristolochiaceae	Mampanchan	Root	Poisonous bites	Paste	Orally	0.09
16.	*Asparagus racemosus* Willd.	Herb	Asparagaceae	Thaneervitan	Tuber	Urinary problems	Paste	Orally	0.04
17.	*Azadirachta indica* A. Juss.	Tree	Meliaceae	Veppilai	Leaves	Stomach problem and Hair growth	Paste and Juice	Orally and external application	0.13
18.	*Agave americana* L.	Herb	Agavaceae	Kattu Katralai	Leaves	Pain reliver (Body pain)	Juice	Orally	0.33
19.	*Allium sativum* L.	Herb	Amaryllidaceae	Vellaipoondu	Bulb	Lactation improvement	Paste	Orally	0.09
20.	*Andrographis echiodes* (L.) Nees	Herb	Acanthaceae	Kopuramthangi	Leaves and Stem	Wound healing	Paste	Orally	0.08
21.	*Andrographis paniculata* (Burm. f.) Nees.	Herb	Acanthaceae	Siriyanangai	Whole plant	Fever and Snake bite	Powder	Orally	0.14
22.	*Arachis hypogaea* L.	Herb	Leguminosae	Nilakadalai	Seed	Irregular menstruation	Raw Seed	Orally	0.05

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
23.	*Areca catechu* L.	Tree	Arecaceae	Kottaipakku	Seed and leaves	Stomach problem, Cough, Cold and Digestion	Raw leaves	Orally	0.35
24.	*Arisaema leschenaultii* Blume	Herb	Araceae	Karunai keerai	Leaves and tuber	Stomach ulcer and Piles	Cooked form	Orally	0.37
25.	*Begonia malabarica* Lam.	Herb	Begoniaceae	Sangunarayana poo	Whole plant	Stomach Problems and Body Heat	Cooked form	Orally	0.22
26.	*Blepharis maderaspatensis* (L.) B. Heyne ex Roth.	Herb	Acanthaceae	Kozhimookan	Stem and Root	Asthma and Cough	Powder	Orally	0.66
27.	*Benincasa hispida* (Thunb.) Cogn	Climber	Cucurbitaeae	Neerpoosani	Leaves	Reduced fat	Cooked form	Orally	0.16
28.	*Bombax ceiba* L.	Tree	Malvaceae	Ilavam panchu	Seeds	Stomach Problems and Body Heat	Cooked form	Orally	0.25
29.	*Cardiospermum halicacabum* L.	Climber	Sapindaceae	Mudakkathan	Leaves	Fever and cough	Raw plant	Orally	1
30.	*Senna auriculata* (L.) Roxb.	Tree	Caesalpiniaceae	Aavaram poo	Flowers	Diabetes and fungal disease	Raw plant	Orally	0.66
31.	*Calotropis gigantea* (L.) Dryand.	Herb	Asclepiadeceae	Erukkam poo	Leaves	Piles disease and leg pain	Fresh juice	Internally and externally	0.33

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
32.	*Cissus quadrangularis* L.	Herb	Vitaceae	Pirandai	Whole plant	Leg pain and lactogenesis	Paste	Orally	0.75
33.	*Ceropegia sp.*	Climber	Apocynaceae	Kattu keerai	Leaves & tubers	Piles problems	Dried Powder	Orally	0.2
34.	*Coccinia grandis* (L.) Voigt.	Climber	Cucurbitaceae	Kovakkai	Leaves and Fruit	Stomach Problems	Decoction	Orally	2.5
35.	*Cleome viscosa* L.	Herb	Cleomaceae	Naaivelai	Leaves	Reduced body pain	Paste	Orally	0.4
36.	*Clitoria ternatea* L.	Herb	Fabaceae	Sangupoo	Flowers	indigestion problem	Decoction	Orally	0.33
37.	*Cymbopogon citratus* (DC.) Stapf.	Shrub	Poaceae	Lemon grass	Tried Leaves and stem	Headache and skin problems	Powder	Internally and externally	0.22
38.	*Psidium cattleyanum* Sabine	Tree	Myrtaceae	Seenikoiya	Leaves and fruit	Dysentery and stomach pain	Paste and Juice	Orally	0.33
39.	*Curculigo orchioides* Gaert.	Herb	Hypoxidaceae	Kurathi nilappanai	Tubers	Energy source	cooked form	Orally	0.16
40.	*Dioscorea bulbifera* L.	Perennial Vine	Dioscoreaceae	Kattuvalli Kilangu	Tuber and stem	Piles problems	Powder	Orally	0.1
41.	*Datura metal* L.	Shrub	Solanaceae	Oomathai chedi	Leaves	Akki disease and Dog bites	Pasted and Juice	Orally	0.18
42.	*Eclipta alba* (L.) Hassk.,	Herb	Asteraceae	Karisalankanni	Fresh leaves	Hair growth	Oil	External application	0.5
43.	*Euphorbia hirta* L.	Herb	Euphorbiaceae	Palpottuthalai	Fresh leaves	Stomach cleaning	Juice	Orally	0.07

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
44.	*Euphorbia tirucalli* L.	Tree	Euphorbiaceae	Kalli chedi	Latex	Hair Problems	Juice	External application	0.33
45.	*Evolvulus alsinoides* (L.) L.	Herb	Convolvulaceae	Vishnukaranthai	Leaves	fever	Juice	Orally	0.2
46.	*Erythrina variegata* L.	Tree	Fabaceae	Mullu murungai	Leaves	Uterus problem	Fresh Form	Orally	0.28
47.	*Flacourtia indica* (Burm.f.) Merr.,	Small Tree	Flacourtiaceae	Pulamullu	Leaves	Loose motion	Juice	Orally	0.1
48.	*Ficus racemosa* L.	Tree	Moraceae	Atthi	Fruit	Diarrhea and energy source	Juice	Orally	0.16
49.	*Glycyrrhiza glabra* L.	Herb	Leguminosae	Athimathuram	Leaves and Bark	Stomach cleaning	Powder	Orally	0.07
50.	*Gossypium hirsutum* L.	Tree	Malvaceae	Ilavam panchu	Seeds	Body Pain	Powder	Orally	1
51.	*Grewia hirsuta* Vahl.	Tree	Tiliaceae	Kootampazham	Root	Wound Pain	Paste	Orally	0.66
52.	*Gymnema sylvestre* (Retz.) R. Br.	Woody vine	Asclepiadaceae	Sakkaraikolli	Leaves	Diabetes	Decoction	Orally	0.5
53.	*Justicia adhatoda* L.	Herb	Acanthaceae	Aduthoda chedi	Leaves	heath drink	Fresh form	Orally	0.14
54.	*Justicia tranquebariensis* Roxb.	Herb	Acanthaceae	Punnaku Poodu	Leaves	Poisonous bites and Chest Pain	Infusion and Paste	External application	0.25

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
55.	*Leucas aspera* (Wild.) Link	Herb	Lamiaceae	Thumbai	Leaves	Cough, cold and fever	Crushed leaves	Inhalation	0.42
56.	*Mentha arvensis* L.	Herb	Lamiaceae	Hallschedi	Leaves	Cough, cold and fever	Decoction	Orally	0.22
57.	*Cucumis maderaspatnus* L.	Climber	Cucurbitaceae	Mosu-mosu kottai	Whole plant	Stomach ulcer and Piles	Powder	Orally	0.09
58.	*Murraya Koenigii* (L.) Spreng	Tree	Rutaceae	Karuveppilai	Leaves	Hair growth	Powder	Orally	0.05
59.	*Ocimum tenuiflorum* L.	Herb	Lamiaceae	Thulasi	Leaves	Cough, cold and Throat infection	Decoction	Orally	1
60.	*Pedalium murex* L.	Shrub	Pedaliaceae	Yannainerunji	Whole plant	Stomach cleaning, Diabetes, Kidney, and Urinary Infection	Fresh form	Orally	0.57
61.	*Persicaria chinensis* L. H. Gross	Creeping weed	Polygonaceae	Palkolai	Stem and leaves	Reduce Thirst and Lactogenesis (Animal)	Fresh form	Orally	0.66
62.	*Hemidesmus indicus* (L.) R. Br.	Herb	Apocynaceae	Nannari	Leaves	Body Heat Reduced	Juice	Orally	0.33
63.	*Hibiscus schizopetalus* (Dyer) Hook.f.	Shrub	Malvaceae	Viriyasemparuthi	Leaves	Skin problem and Itching	Paste	Both internal and External	0.66

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
64.	*Ipomoea indica* (Burm. f.) Merr.	Climber	Convolvulaceae	Paalkodi	Whole plant	Lactation improvement (Animal)	Fresh form	Orally	0.33
65.	*Jatropha glandulifera* Roxb.	Tree	Euphorbiaceae	Aathalai	Leaves	Energy source	Juice	Orally	0.2
66.	*Lantana camara* L.	Shrub	Verbenaceae	Unnichedi	Root	Stomach problem	Powder	Orally	0.2
67.	*Psidium guajava* L.	Tree	Myrtaceae	Kattu Koiya	Leaves and Fruits	Diarrhea	Juice	Orally	0.09
68.	*Ruta graveolens* L.	Herb	Rutaceae	Seerpachilai	Leaves	Skin disease and abortion	Paste	External and Internal apply	0.12
69.	*Rubus ellipticus* Sm.	Herb	Rosaceae	Unnipazham	Fruits	Gastric problem	Juice	Orally	0.11
70.	*Santalum album* L.	Tree	Santalaceae	Santhanam	Bark and flowers	Skin problems and Scent flavor	Powder	External application	0.33
71.	*Sesamum indicum* L.	Herb	Pedaliaceae	Ellu	Seed	Easy Pregnancy	Powder	Orally	0.4
72.	*Senna alata* (L.) Roxb.	Small tree	Fabaceae	Semmai agathi	Leaves	Skine problem	Juice	External application	0.14
73.	*Solanum americanum* Mill.	Herb	Solanaceae	Milagu thakkali keerai	Leaves	Stomach problem	Cooked form	Orally	0.05
74.	*Solanum lycopersicum* L.	Herb	Solanaceae	Thakkali	Fruits	Stomach cleaning	Fresh form	Orally	0.05

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
75.	*Solanum peudocapsicum* L.	Herb	Solanaceae	Sundakkai	Fruits	Diabetes and Kill stomach warms	Dried form	Orally	0.12
76.	*Stevia rebaudiana* (Bertoni) Bertoni	Herb	Asteraceae	Seeni thulasi	Leaves	Diabetes	Powder	Orally	0.07
77.	*Syzygium* sp.	Tree	Myrtaceae	Kattu naaval	Fruits and leaves	Diabetes	Powder	Orally	0.12
78.	*Solanum nigrum* L.	Herb	Solanaceae	Sirukeerai	Leaves, stem, and Root	Stomach problem	Cooked form and Decoction	Orally	0.22
79.	*Solanum trilobatum* L.	Herb	Solanaceae	Thudhuvalai	Leaves	Cough and cold	Decoction	Orally	0.33
80.	*Sterculia urens* Roxb.,	Small tree	Malvaceae	Senthanakku	Root	Abortion	Paste	Orally	0.14
81.	*Tamarindus indica* L.	Tree	Fabaceae	puliyamarm	Leaves and bark	Gastric problem and Stomach problem	Decoction	Orally	0.25
82.	*Tectona grandis* L. f.	Tree	Lamiaceae	Thekku Maram	Leaves and bark	Born fracture	Oil	External application	0.16
83.	*Terminalia chebula* Retz.	Tree	Combretaceae	Kadukkai	Fruit	Indigestion problem and constipation	Dried form	Orally	0.4
84.	*Terminalia arjuna* (Roxb.) Wight &Arn	Tree	Combretaceae	Maruthamaram	Bark	Gastric problem	Powder	Orally	0.09

Table 1 (continued)

S. no.	Scientific name	Habit	Family	Vernacular Name	Part used	Ailments/ Medical Complications	Formation	Mode of action	Use Value (UV)
85.	*Terminalia catappa* L.	Tree	Combretaceae	Thandrikkai	Fruit	Stomach problem and Indigestion problem	Powder	Orally	0.13
86.	*Tribulus terrestris* L.	Herb	Zygophyllaceae	Nerinjimull	Stem and Leaves	Kidney problem	Powder	Orally	0.05
87.	*Tridax procumbens* L.	Herb	Asteraceae	Thatha poochedi	Leaves	Body pain	Pate	External application	0.04
88.	*Trigonella foenum-graecum* L.	Herb	Fabaceae	Venthayam	Seed	Body heat reduced and hair growth	Fresh form	External application	0.22
89.	*Vitex negundo* L.	Shrub	Verbenaceae	Notchi	Leaves	Headache, Cough and cold	fresh form	External application	0.42
90.	*Vetiveria zizanioides* (Linn) Nash.	Shrub	Poaceae	Vettiver	Leaves and Root	Fever, cough, and digestion	Decoction	Orally	0.37
91.	*Withania somnifera* (L.) Dunal	Shrub	Solanaceae	Amkura	Root	Body strength	Powder	Orally	2
92.	*Ziziphus mauritiana* Lam.	Tree	Rhamnaceae	Periya Illanthai	Fruits and leaves	Vitamin Source	Fresh form	Orally	0.33
93.	*Ziziphus jujube* Mill.	Herb	Rhamnaceae	Illanthai pazham	Fruit	Reduced body heat	Fresh form	Orally	0.1

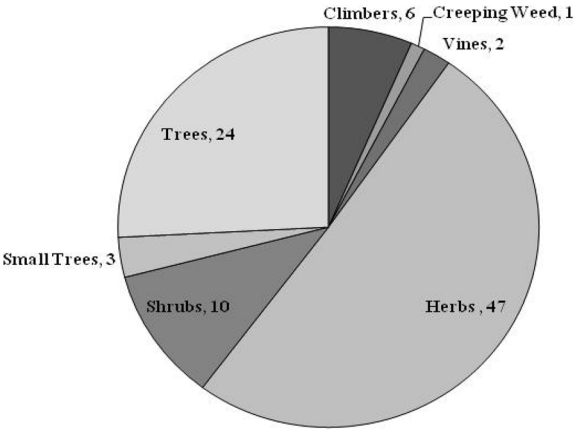

Fig. 4 Distribution of medicinal plants

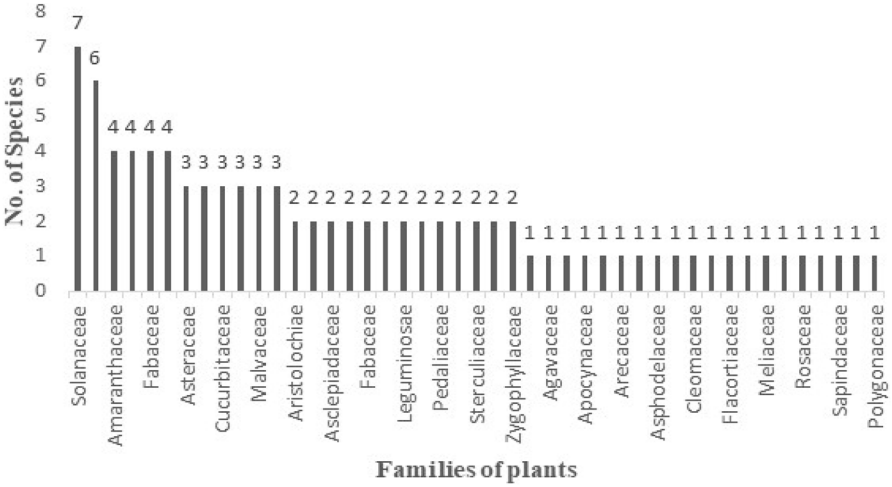

Fig. 5 Families of medicinal plants

Ailments have been categorized into 41 categories. In the present study (Table 2), the informant's consensus factor was high (1.00) for 15 ailments (asthma, weak body strength, bone fracture, dysentery, easy pregnancy, eye infection, fungal disease, irregular menstruation, kidney problem, deworming, reduction of fats, throat infection, toothache, uterus problem, and vitamin source). For the ICF, a high value indicates that most informants have a consensus for a specific plant that may be used for a particular ailment. However, the lowest informant's consensus (0.50) was reported for abortion and poisonous bites. The result indicates a lower level of unanimity or agreement among informants over using a reported plant species about a particular disease category. A low ICF value symbolizes the lowered use of some traditional remedies.

4 Discussion

The traditional medicinal/ethnomedicinal practices of different tribal groups are highly influenced by their living conditions, education level, socio-cultural conditioning, social-economic status, and socioreligious beliefs and practices. Traditional medicines are a vital but often underestimated part of healthcare. The study indicated that the study area is rich in medicinal plants. In a previous study, it was found that Paliyar tribal people strongly believe in folk medicine due to its low cost and being a part of their socio-cultural life (Jeyaprakash et al. 2011). The ethnomedicinal practices play a vital role in the daily lives of the Paliyar tribe people. They often use more than a single plant synergistically to cure diseases immediately. A fresh part of the plant is usually preferred for medicine preparation, but due to the unavailability of fresh plant parts, dried parts are also used as simple drugs. For example, to protect themselves from leech bites, the tribals crush the fruits of *Solanum erianthum* and apply them topically on their legs. Like other tribals, they, too, can distinguish characters of various plants and their beneficial properties (Ariharan and Revathi 2021). As the study results are in accordance with previous studies, people from different age groups have participated in the ethnomedicinal study of the plants. The percentage varied, but none of the age groups showed zero value. Similarly, identifying 93 species of plants by a community is again proof that the Paliyar tribe is thorough with their ethnic knowledge about the local plants in the forest area. Correspondingly, higher UV and ICF values for the listed plants further strengthen the belief that the locally available plants have much use in their daily lives from the point of ethnomedicine.

However, gradually, there has been an erosion in ethnomedicinal knowledge of the community because of the destruction of forests and their products, fragmentation, lifestyle change, and unemployment issues among the youth of the Paliyar tribe community. Therefore, there is an urgent need to document this oral knowledge as soon as possible for a broader application in the future. In the present study, more than 7 plants were used for the common diseases of skin problems, and several researchers also reported that the different plant parts used to cure wound healing and various skin diseases (Saikia et al. 2006; Harsha et al. 2003; Coon and Ernst 2004). Nowadays, hair problems are among the most common due to the use of adulterants in hair oil and stress. Study reveals that the Paliyar people, particularly women, are giving more importance to hair growth and using many plants to remedy hair fall. 11 plants were used for skin diseases such as allergies, psoriasis, or any patches. Ayyanar and Ignacimuthu (2005) also reported about the Kani group in the Thirunelvelli districts and 28 plants; among them, 13 plants were used for skin disease and hair growth.

Another common problem was headaches; most Lamiaceae family plants were used to treat colds, coughs, and headaches. In the study, the Paliyar tribal people used the decoction of plants of Poaceae (*Cymbopogon citratus*), Lamiaceae (*Leucus aspera*), and Verbenaceae (*Vitex negundo*) family to treat headaches. Ignacimuthu et al. (2006) reported that *Ceropegia candelabrum* and *Vitax negundo* were home remedies for headaches. *Arisaema leschenaultii*, *Ceropegia* sp, and *Dioscorea*

Fig. 6 Few medicinal plants (**a**) *Santalum album* (**b**) *Justicia adhatoda* (**c**) *Ocimum* sp. (**d**) *Amaranthus spinosa* (**e**) *Tridax procumbens* (**f**) *Clitoria ternatea* (**g**) *Ruta graveolens* (**h**) *Euphorbia tirucalli* (**i**) *Vetiveria zizaniodes* (**j**) *Senna auriculate* (**k**) *Hibiscus schizopetalus* (**l**) *Arisaema leschenaultii* (**m**) *Ipomea indica* (**n**) *Psidium gujava* (**o**) *Calotropis gigantea* (**p**) *Persicaria chinensis* (**q**) *Murraya koenigii* (**r**) *Cissus quadrangularis* (**s**) *Passiflora* sp. (**t**) *Terminalia catappa* (**u**) *Azadirachta indica* (**v**) *Syzigium* sp. (**w**) *Euphorbia hirta* (**x**) *Cerapegia* sp. (**y**) *Solanum pseudocapsicum*

bulbifera tubers are used to cure piles disease. Even in the Malayali tribals, the powder of roots of *Hemidusmus indicus* was used to cure piles disease (Suresh et al. 2011). In this study, interestingly, two plants were recorded as ethno-veterinary medicinal plants (*Persicaria chinensis* and *Ipomoea indica*), and both were used to increase the lactogen content of cows and goats. The remedies are expected to treat humans and animals. Apart from the medicinal properties of the plants, no other information was disclosed by the people surveyed. Some ethnobotanical studies have also been reported to explore the knowledge from various tribal communities of Tamil Nadu in treating humans as well as domestic animals (Rajan et al. 1997; Kiruba et al. 2006; Devendrakumar and Anbazhagan 2012).

In this study, ICF is used to evaluate the reliability of the information obtained about plant use. A high ICF value for a particular ailment signifies the use of some particular plants by many inhabitants to cure it, whereas a low value means the use of varied plants by many inhabitants to cure a particular health issue. The high degree of ICF also symbolizes that Indigenous people have a high degree of conformity to using specific plants for specific diseases due to their rich knowledge about the traditional use of that plant, which has been passed on to them through their ancestors. It also reflects that the current generation has kept knowledge intact by using it firmly

Fig. 7 Traditional medical practitioners of Paliyar Tribe, Theni District, Tamil Nadu

to find solutions for day-to-day health problems but preserving existing traditional knowledge is a must before much has been lost. The more versatile the plant is with its therapeutic properties, the more cultural significance it holds.

Further, such traditional significance is related to the different uses of the plants known by different communities over the generations. The importance of ethnomedicinal plants is based on their adaptability and variety of applications, which could allow decision-making processes to include traditional medicines in the class of contemporary medicines. Most of the documented species in the present study may stimulate the appropriate legislative bodies to frame better conservation and management strategies for the plants used for medicinal purposes.

Table 2 Consensus Index (ICF) for medicinal plants

S. No.	Disease/ Medical complications	ICF
1	Abortion	0.5
2	Asthma	1
3	Body heat reduce	0.69
4	Body Pain/ Chest pain	0.82
5	Body strength	1
6	Bone fracture	1
7	Cold	0.54
8	Cough	0.11
9	Diabetes	0.58
10	Diarrhea	0.87
11	Digestion/ Constipation	0.66
12	Dysentery	1
13	Energy source	0.66
14	Easy Pregnancy	1
15	Eye infection	1
16	Fever	0.64
17	Fungal disease	1
18	Gastric problem	0
19	Hair Growth and Hair Problems	0.66
20	Headache	0.95
21	Health drink/Thirsty reducer	0.87
22	Irregular menstruation	1
23	Kidney problem	1
24	Kidney stone	0.83
25	Kill Stomach worm	1
26	Lactation improvement	0.9
27	Lactation improvement (Animal)	0.93
28	Leg pain	0.87
29	Piles disease	0.77
30	Poisonous bites	0.5
31	Psoriasis (Skin disease)	0.93
32	Reduced body heat/ Body pain reliever	0.84
33	Reduced fat	1
34	Skin disease	0.70
35	Stomach problems/ Ulcer /pain	0.53
36	Throat infection	1
37	Toothache	1
38	Urinary infection	0.92
39	Uterus problem	1
40	Vitamin Source	1
41	Wound healing/pain reducer	0.97

The oral transmission of traditional knowledge is a part of Local Environmental Knowledge (LEK) that has proved critical in allowing societies to survive in various environments and to adapt to social-ecological changes. The primary threat to such oral transmissions is the death of the older generations or the senior citizens of a community who hold valuable knowledge that can become extinct with their death. Other challenges include age-related differences in the perceptions of ecological changes and decreasing intergenerational knowledge transfer (Fernandez-Llamazares et al. 2015). It is the mutual responsibility of both the generations to transfer and imbibe the valuable ecological knowledge. Fortunately, in our study, the maximum number of informants (35.9%) belonged to the age group of 18–35 years, indicating a positive sign that the younger generations are aware of ethnobotanical knowledge. Rapid deforestation due to growing urbanization is another issue that comes under global ecological challenge, which is responsible for the extinction of many medicinally important flora that are identified by local names by the indigenous people. From the investigation, it can be concluded that the Paliyar community is essential not only for its tribal origin, which is slowly on the verge of extinction, but also for the quick revival of the traditional medicinal knowledge this community possesses. The importance of medicinal plants and the knowledge of herbal therapies carried out by the Paliyar tribe community were validated by UV and ICF. It proved to be rich in terms of knowledge and biodiversity. Tribal communities now differ from those of the past due to modernization and globalization.

Further, it is to be noted that ethnic medicine is making its way into modernization. Countries like Myanmar have been constructing a medicinal system based mainly on the Burman tradition across the country that could compete with biomedicine, if not overtake it (Codrey 2021). A U.K.-based survey indicated that the wide use of herbal medicine, or the general use of herbs for health, has recently gained momentum in the country (Lazarou and Heinrich 2019). Community trust in traditional medicines in Malaysia is still relatively high as the statistics reveal that the use of medicinal plants is based on use values reaching 0.64 and animal-sourced traditional medicines of 92.59 (Henri and Erpandi 2021). After the COVID-19 pandemic, many countries look forward to traditional medicines and improved vaccines. In Africa, herbal medicines are used based on traditional African medicines (ATMs) to manage post-COVID health stress (Attah et al. 2021). Hence, it can be established from the above facts that ethnic medicine is prominent and influential globally. Traditional knowledge of indigenous medicinal plants is essential for further scientific investigation of plant species and their genetic diversification. The various traits can be used to formulate essential biomedicines to prevent and cure acute and chronic diseases. Ethnomedicine can become a viable option for Public Health by upscaling the knowledge of traditional herbalists and by providing approval about their traditional practices as well as widening the curriculum and job opportunities in the contemporary healthcare system to include ethnomedicine and verbatim traditional health concepts and practices (Mutatkar 2023).

Regarding the preservation of the Paliyar tribe of the Theni District, there should be sustainable development of their livelihood. To generate employment and a continuous source of income for rural communities, people need to commercialize a subsistence trade for non-timber forest products (NTFPs). The Theni District has

not only assorted geography but also varied climatic conditions; hence, forest-grown MAP (Medicinal and Aromatic Plants) are highly available as important resources, making economically and botanically imperative for Southern India's MAP industry. Some of the crucial measures taken for the tribe could be appropriate access to education facilities, hands-on training for the youth in collecting plants, workshops, seminars on preserving local flora, and sensitization towards the importance of traditional ecological knowledge. These should be arranged by the local legislative bodies to empower the younger generation towards the conservancy of traditional knowledge. There could be other possible recommendations, too, which are beyond the scope of the paper.

5 Conclusion

It has been summarized that being the ethnic community of the Theni District of Tamil Nadu, the Paliyar tribe has been responsibly preserving the ethnobotanical knowledge of the use of native medicinal plant species from one generation to another. This traditional knowledge has been passed orally through the pedigree, probably without written records. Hence, the study highlighted their efforts to conserve the ethnomedicinal knowledge of the native plants. The study can be considered a model for several more investigations about different tribal communities in India having ethnobotanical or ethnoveterinary knowledge of the local flora. Their knowledge can be tapped and pooled to construct an ethnomedicine knowledge bank in the country. A comparative study could be designed to collect the indigenous knowledge possessed by different tribal groups in India. The study also suggested that scientific surveys and protection of such ethnic groups are mandatory to preserve the ethnomedicinal knowledge of the plants. The listed plants and their medicinal usage found during the investigation, combined with expertise in modern medical sciences, could help improve healthcare systems in India as well as globally.

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Authors' contributions CL and DC conceived and designed the study. DC conducted the study, DC & MP analyzed data and wrote the manuscript, MG assisted in the data extraction through interaction with tribal people and collection of plant specimens, and RR aided in the taxonomical identification of plant specimens and prepared the herbarium materials. CL reviewed the manuscript. All authors read and approved the manuscript.

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Availability of data and materials The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration

Ethics approval and consent to participate The study included a survey-based interview of the participants and the informants' choice of ethnomedicinal plants for which they were willing to share the information. The participants were willing to share their personal information in the form of their photographs. A sample of the survey form is attached as Fig. 3. No human was harmed during the study. Ethics approval is not applicable.

Consent for publication All authors give their consent for publication.

Competing interests The authors declare that they have no competing interests.

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Comments