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Ethnomedicinal survey of plants used by the traditional medicinal practitioners of Chitradurga District, Karnataka State, India with emphases on the protection of traditional knowledge and threatened species

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Abstract

Maintaining the data of medicinally significant herbs used by the traditional medicinal practitioners for therapy pave way for recording and unveiling traditional knowledge to this modern herbal drug researchers and industries. In this framework, an extensive survey was conducted among the local ethnic healers in Chitradurga district, Karnataka state, India. A systematic exploration of herbal medicinal plants was carried out in the different villages of six taluks of the district based on field visits and interviews in their native local language using a standard questionnaire. In the survey, traditional medicinal knowledge of practitioners was documented. A sum of 190 medicinal herbs belonging to 156 genera and 75 families used by the 112 practitioners have been recorded, authenticated, listed and categorized. Traditional knowledge of medicinal plants, their parts used, drug formulations, and dosages including treatment methods was documented. The practitioners found difficult to get certain seasonal medicinal herbs for treatment and listed them under rare and threatened species. Medicinal practitioners belonging to the different ethnic communities were interviewed to record several herbal medicinal plants used in their traditional knowledge to treat diseases and reported the herbal formulations for certain ailments as well. The survey also revealed the nine medicinally important threatened herbal species and recommended biotechnological methods to restore the threatened species. Our findings would be a useful massive database for phyto-pharmaceutical researchers for novel herbal drug development.

Keywords: Chitradurga district, Ethnic group, Medicinal plants, Nayaka, Traditional knowledge

Introduction

The ethnomedicinal survey is one of the main branches of botany in which medicinal plants are explored, collected, authenticated and documented from a locality based on its uses in the prevention, diagnosis, and treatment of diseases by the traditional medicinal practitioners. It is the information practitioners acquire from their ancestors to heal the ailments of local patients with the native plants [1]. The WHO reported that around eighty percent of people depend upon alternative remedy to treat various ailments and it is also considered as the first health care resource in several countries. The use of medicinal plants for humans has an extensive past [2, 3].

In the year 1896, John Harshberger, an American botanist coined the term ethnobotany in his maiden effort to investigate the plants preferred by the native tribal people, and later it became their local knowledge among different people [1]. Thorough knowledge of medicines was available for the inhibition and therapy of many illnesses in ancient scholastic works such as Atharva Veda, Charaka, Sushruta, etc. More than 3,000 years of herbal heritage in the Indian medicinal plants was reported, moreover, it is declared that local healers use herbs that serve as natural principles of medicine [4]. Medicinal plant species include herbs, shrubs, climbers, trees, and annuals to perennials [5]. Man relied on plants as a sole source of medicine and it has been transmitted from ancestors and passes to next generation. Importantly, it is found that out of 250,000 flowering plant species only 1.2% have been explored and analysed for medicinal value [6] but still, the exploration of traditional knowledge (TK) and the use of herbs is orally transmitted by locals [7].

Less number of herbs, their distribution area, endemism, trade in the wildlife, and destructive harvesting mode, many medicinal plants have become threatened [8]. In Karnataka state, India people belong to the Chitradurga district used to approach many traditional medicinal practitioners to treat many diseases and get cured. However, the ethnomedicinal survey of only a few taluks like Molakalmuru, Chitradurga and the Jogimatti [5, 6, 7, 9].

Forest are reported but the rich traditional knowledge of the various medicinal practitioners, the ethnic community of all the six taluks of the district is not completely explored and reported in detail.

Documentation of ethnic healers' practices is vital for conserving traditional knowledge and must be protected for further research and development in the exploration of new herbal drug molecules from unexplored plant resources.

Ethnobotanical studies are vital for establishing priority in neighbourhood benefits [10]. Hence, the current investigation was focused to carry out a comprehensive ethnomedicinal study of herbs used to prevent and treat different ailments by the informants or medicine practitioners or local tribal communities of Chitradurga district. This would be valuable in understanding the traditional knowledge, family secrets of medical practitioners of the locality, and their approach in curing various ailments.

Despite, it helps in gathering and the establishment of a medicinal plant database of the study area, which helps us to know the current status of the plant biodiversity threats if any. Furthermore, these documented ethnomedicinal plants database shall be subjected to phytochemical analysis, identification of key bioactive molecules and investigation of their therapeutic potential for various diseases as endorsed by the healers.

Materials and Methods

Study area

Chitradurga District belong to Karnataka State, India with 8,388 square kilometers area including six taluks viz. Molakalmuru (Latitude 14.7097, Longitude 76.7458 and altitude 618 m), Challakere (Latitude 14.3134, Longitude 76.6498 and altitude 585 m), Hiriyur (Latitude 13.943001, Longitude 76.617545 and altitude 630 m), Hosadurga (Latitude 13.7988, Longitude 76.2831 and altitude 739 m), Holalkere (Latitude 14.041608, Longitude 76.183961 and altitude 710 m) and Chitradurga (Latitude 14.2266, Longitude 76.4005 and altitude 732 m) (Fig.1). The study area has an average of 40 rainy days, the average annual precipitation is about 58 cm, temperature 41^0 C (Max), and 17^0 C (Min). The relative humidity is high in the monsoon ranging from 70% to 75%. The relative humidity is poor for the rest of the year, especially in the summer months, and may drop to less than 30% in the afternoon. The landscape is irregular with occasional line of hills having tropical dry deciduous and tropical thorn forests.

Ethnobotanical survey, plant collection, identification, and preservation

The present investigation is an effort to ethnomedicinal plants used for the treatment by the various traditional medicinal practitioners of Chitradurga District. The practitioners were interviewed in 105 villages of the six taluks in the study area from September 2014 to August 2016 to gather ethnomedicinal information. In this survey, a standard questionnaire was framed and used to interview the traditional medicinal practitioners in their native local language (Kannada) [11]. The questionnaire comprised the details viz. name of the village, taluk, and practitioner; age, sex, ethnic community, traditional knowledge, expertise if any, diseases treated, plants with their vernacular names, and their parts used; herbal drug formulations and dosages. During the survey, all the ethnomedicinal information from the herbal medicinal practitioners were enlisted taluk wise, collected the 10 to14 inch plant specimens with the practitioners, the plant specimen, their useful parts, and practitioners were photographed. Vernacular names of the plants used by the practitioners were compared, identified, compiled [12, 13]. Plants' specimen botanical names were confirmed by using valid floras [14, 15, 16, 17, 18, 19, 20, 21], the binomials of herbs were verified (http://www.theplantlist.org) and documented. The collected plants were pressed for moisture removal with the plant voucher no., processed the plants to dry, treated with 5% $HgCl_2$ to fix on herbarium boards, and preserved [22, 23 and 24]. All the preserved specimens were deposited in the Department of Botany, I. D. S. G. Government College, Chikkamagaluru, Karnataka, India.

Results

The extensive collection of ethnomedicinal knowledge of practitioners during a visit to the study area, they were interviewed from 7 to 10 AM and 4 PM to 7 PM IST schedules. In between times, they are also engaged in their work like agriculture, grazing animals, etc. and data was recorded. After every interview, the healers were requested to show the medicinal plants from their village and the medicinal plants were collected and photographed on site. Aerial parts of plants were processed for standard herbarium preparation and identified based on the standard taxonomic keys. Overall 37 field visits were conducted with 4-5 days for each visit. According to Ayurveda practice and healer’s information, usually, the medicines are given and advised to the patients to consume early before any food. Nevertheless, the selection of plants, dosage, and time of treatment plays a very important role in curing most of the diseases**.**

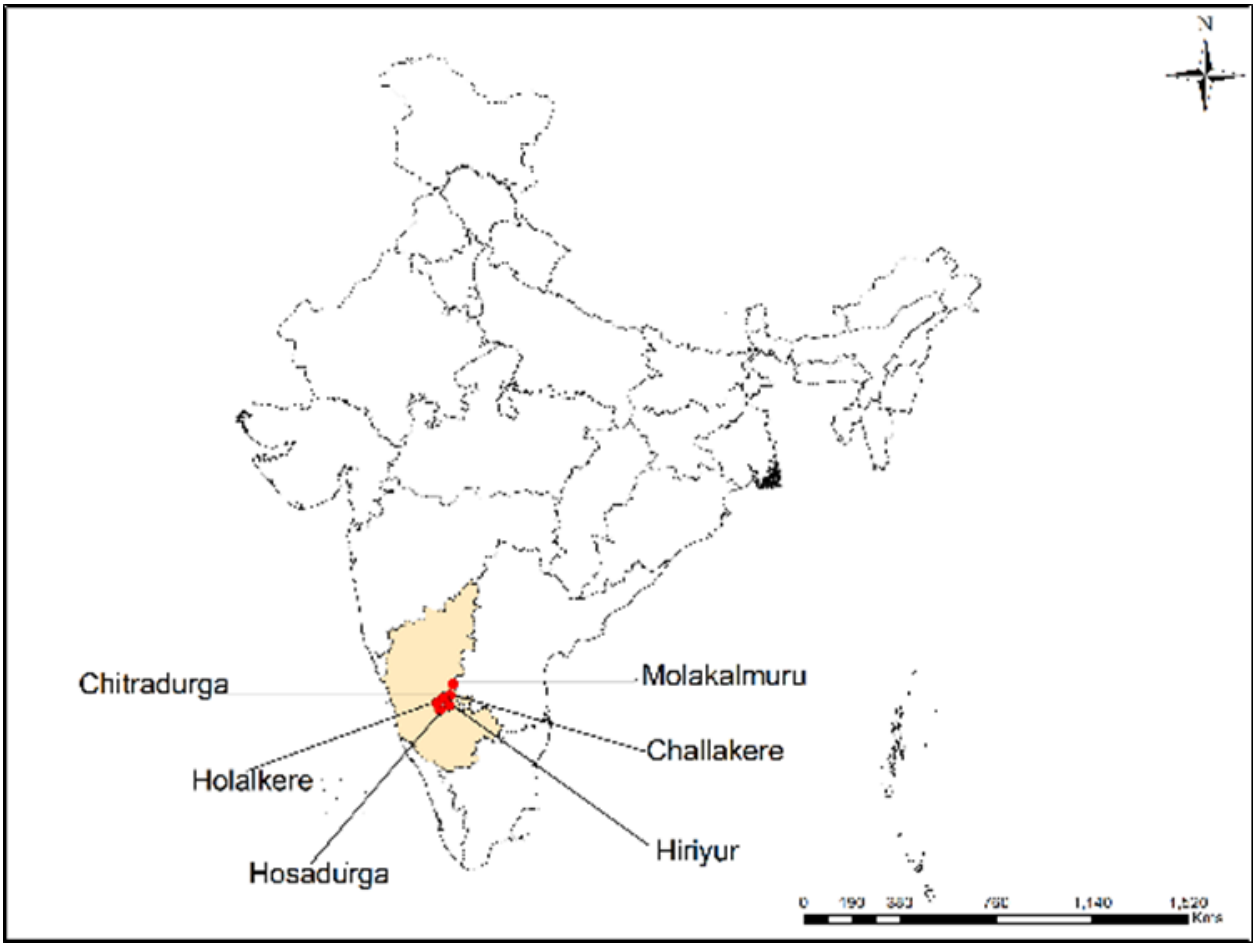

Fig 1: Map of ethnomedicinal survey zone with six taluks under Chitradurga district, Karnataka state, India.

In the investigated area, 190 useful herbs of 156 genera and 75 families have been endorsed to treat 173 diseases and all the plants were identified, listed, categorized, and analyzed. The present study was conducted from a total of 112 practitioners in different villages of six taluks of the study area (Table1 and Fig. 1). Very few practitioners are unwilling to share their TK information about curing diseases other than their family members.

Table 1: Consolidated ethnomedicinal survey data of six taluks of Chitradurga district, Karnataka state, India.

Sl. No	Taluk Name	No. of villages	Practitioners details			No. of plants documented			No. of diseases treated
			M	F	Age group	Family	Genera	Species	
1	Molakalmuru	13	13	2	44-74	48	80	94	167
2	Challakere	15	13	4	40-70	41	73	83	132
3	Hiriyur	19	18	3	36-78	45	64	74	119
4	Hosadurga	20	13	2	37-70	47	75	91	147
5	Holalkere	14	16	4	34-83	45	71	81	124
6	Chitradurga	24	20	4	38-81	46	76	91	132

*M- Male, F- Female

In the survey, it was observed that the health healers were aged between 34 and 83 years, their communities or they had a history of healing and also had the TK of plants, their medicinal use, drug formulations and dosages including treatment methods for various diseases or specialists in only certain disease treatment (Fig. 2). Ethnic groups like Nayaka, Elava, Golla, Naik, Marati, Beda, Hakki-Pikki, Korachaa nd Lambani were found in many areas. Compare to other ethnic groups Nayaka tribes found in all the taluks of the study area. Many of the tribes live in remote villages and in hilly areas, most of the practitioners have learned the medicinal knowledge from their ancestors. Some of the herbal practitioners have learned on their own. The medicinal plants used by the practitioners include herbs (81species), shrubs (33species), trees (53 species) and climbers (23 species) and the highest representative of 13 species from the family Fabaceae; 10 each from Asteraceae and Caesalpiniaceae; 8 species from Lamiaceae, 7 species each represented from Apiaceae and Zingiberaceae; Euphorbiaceae 6 species; 5 species each from Asclepiadaceae, Liliaceae, Malvaceae, Mimosaceae and Poaceae; 4 species each from Acanthaceae, Apocynaceae, Arecaceae, Convolvulaceae, Cucurbitaceae, and Solanaceae; 3 species each from Amaranthaceae, Combretaceae, Moraceae, Nyctaginaceae, Myrtaceae, Piperaceae and Rutaceae; 2 species each from Adiantaceae, Anacardiaceae, Aristolochiaceae, Brassicaceae, Pedaliaceae, Periplocaceae, Rosaceae and Verbenaceae while the rest of 42 families have one species each (Fig. 3). This shows

Fig 2: On-site pictures of traditional medicinal practitioners of the study area. A- Practitioner Anjinamma treating a patient (identity hidden) with burnt wounds, B- Shivarudrappa treating a patient (identity hidden) with infected skin, C- Nagaraj preparing herbal medicine, D- Different herbal formulations prepared and stored, Practitioners E- Basavaraj (48 Years), F- Bosayya (45 Years), G- Doddamma (58 Years), H- Ganesh (65 Years), I- Rudramma, (50 Years) and J- Chowdanaik (53 Years).

The wide variations in the herbals which are vital sources of alternative medicines for the inhabitants.

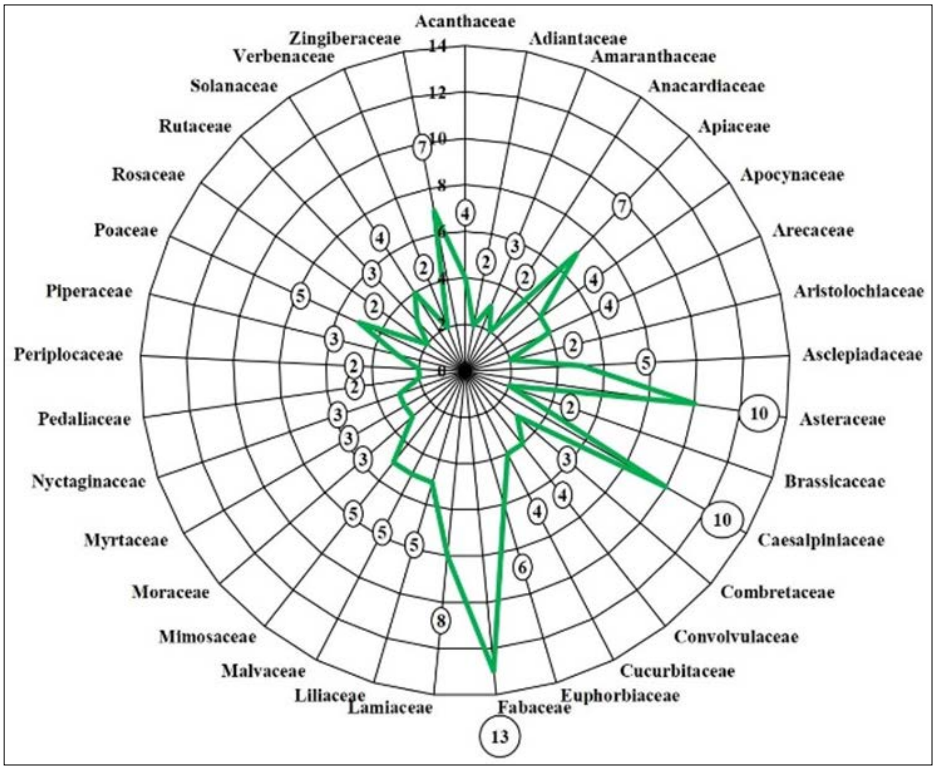

Fig 3: Representatives of different families of plants recorded in the study area used by herbal practitioners.

The practitioners have used various parts of herbs as raw material for drugs. In that, the leaves (35.78 %) were predominantly used to treat sicknesses then root (17.9), fruit (16.3 %), seeds (12.6 %), stem bark (10.5 %), aerial parts (10 %) and stem (6.8 %) (Fig. 4).

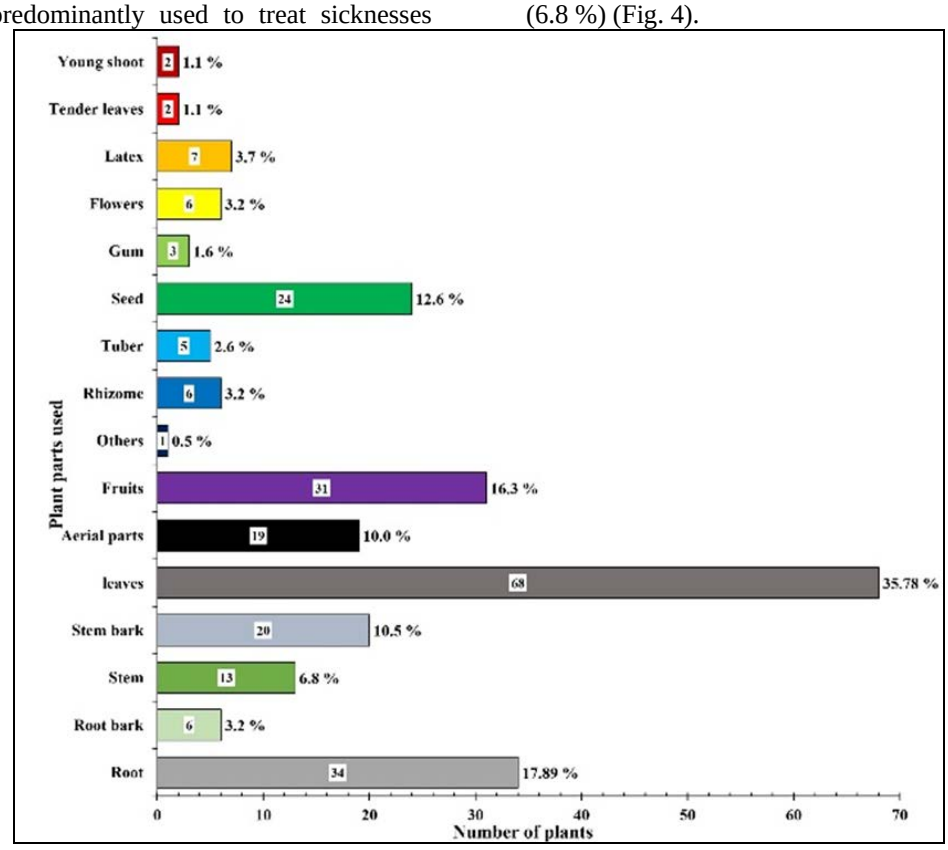

Fig 4: Plant parts used by the practitioners of the Chitradurga district to prepare herbal drugs.

Some of the herbs used by the tribes and practitioners to cure illnesses are *Acalypha indica* (scorpion sting), *Aerva lanata* (renal calculi), *Alangium salvifolium* (bone fractures), *Blepharis repens* (bone fractures), *Cassia absus* (snake bite), *Corallocarpus epigaeus* (snake bite), *Decalepis hamiltonii* (lung infection and circulatory problems), *Pedalium murex* (utero-tonic), *Rauwolfia serpentina* (paralysis), *Solanum pubescens* (cancer), *Plumbago zeylanica* (Bronchial Asthama) and *Ximenia americana* (antiseptic for umbilical cord) (Fig. 5).

Fig 5: On-site pictures of important ethnomedicinal plants used by the traditional medicinal practitioners of Chitradurga District to treat various diseases. A- *Alangium salvifolium*[#], *B- Cassia absus*[#], C- *Corallocarpus epigaeus*[#], D- *Decalepis hamiltonii*, E- *Pedalium murex*[#], F- *Solanum pubescens*[#], G- *Plumbago zeylanica*[#] and H- *Ximenia americana*[#], I- *Tinospora cordifolia*, J- *Aristolochia bracteolate*, K- *Withania somnifera* and L- *Diplocyclos palmatus*. [#] Threatened species.

The healers use plant extracts, powder, cold-infusion, decoction, paste, tablets, and in conjunction with other plant parts (polyherbal or compound formulations) for internal or external application. Leaves were the major ingredients in formulations; the prepared drugs like handmade tablets will be dried under shade and prescribed to the patients. Along with the drug, patients are advised on the choice of food while on medication. The majority of the herbal medicines (63%) are taken orally, 26% are externally applied and folk healers often adopt other forms of administration. (Fig. 6).

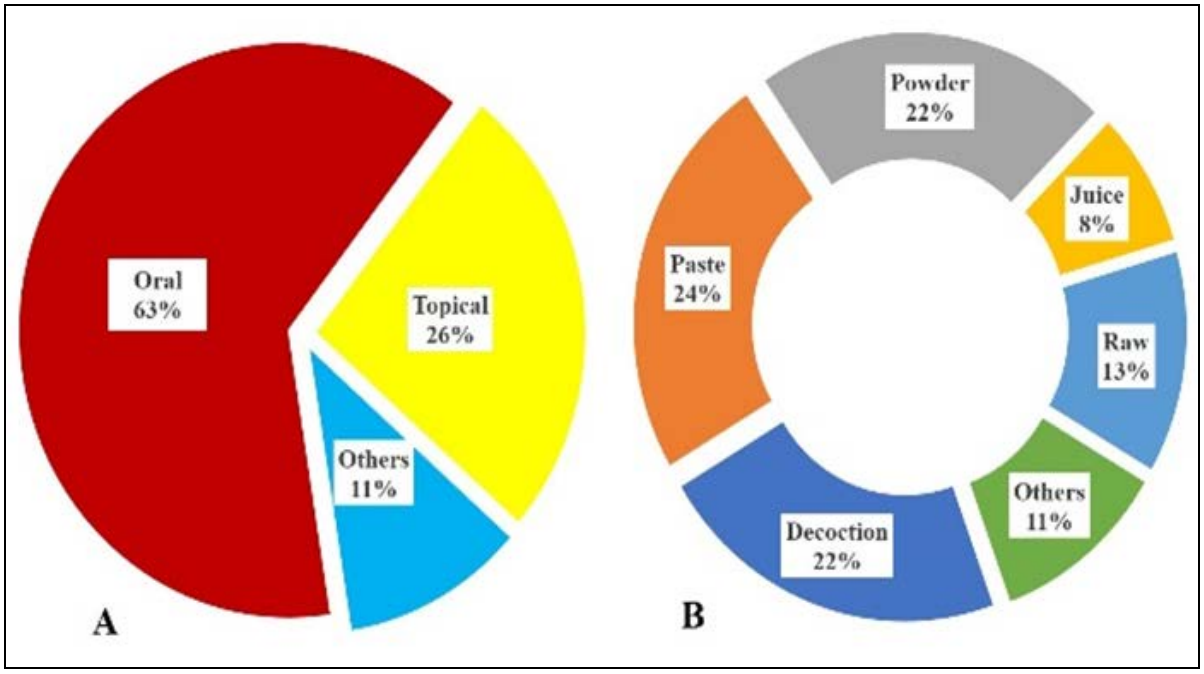

Fig 6: Traditional knowledge of healers. A- Mode of drug applications and B- Method of herbal drug preparations.

Discussion

The Chitradurga district ethnomedicinal survey revealed enormous important information about medicinal plants used in tribal people's lives that are entwined around the forest ecosystem and land resources. The diverse tribal population used the repository of cumulative experience and traditional knowledge of native plants for generations together in their primary health care [25]. An ethnobotanical survey was reported in the Jogimatti forest area of Chitradurga taluk as well as in the Molakalmuru Taluk [5, 6, 7 and 9]. Reports from the neighbouring districts have also been found [26, 27 and 28]. Remarkably, in the present survey, a massive medicinal herbs database has been generated from the traditional healers' information, used for various diseases with herbal formulations, preparations, applications for certain diseases by covering 105 villages and also threatened herbal species and relevant remedial measures were described.

Phytomedicine knowledge of tribes from various parts of India has been reported from Tirunelveli hills of Western Ghats [29], Lahore, Pakistan [30], Sedum Taluk, Kalaburgi, Karnataka, South India[31], Vathalmalai Peaks, Eastern Ghats, Dharmapuri Dt., Tamil Nadu [32]. In the current study, plants from members of the Fabaceae, Asteraceae, Caesalpiniaceae and Lamiaceae family have often been used by contemporary practitioners in Chitradurga District to prepare herbal formulations and an ethnobotanical survey is an important tool for documenting the traditional knowledge in abroad. Ethiopian practitioners have used the Fabaceae and Lamiaceae members frequently in their formulations; South East Ethiopian used the highest members of Euphorbiaceae [33]. In Yemen, 195 medicinal plant species have been reported for 155 specific illnesses with the most frequently used plants from Apocynaceae, Fabaceae, Euphorbiaceae and Asteraceae [34]. In Papantla, Veracruz, Mexico, many such herbs was documented [35] in central Macedonia, Greece a maximum of 96 informants used 87 plant taxa to cure a variety of diseases [36].

The ethnic practitioners aimed to maintain the traditional medicine at cheaper cost for their local community, and few are practicing it for free. Some practitioners have expressed their views that they need support from the Government in maintaining

the important medicinal plants as a community at the village level to protect them from the loss of valuable herbal biodiversity, as already few became threatened species (Fig. 5). According to the medicinal practitioner's information, certain seasonal medicinal plants in the study area have become threatened due to climate change, and they are viz. *Aristolochia bracteolate*, *Aerva lanata*, *Blepharis repens*, *Boerhavia chinensis*, *Corallocarpus epigaeus*, *Decalepis hamiltonii*, *Pedalium murex*, *Picrorhiza scrophulariiflora* and *Ximenia americana*. So, these scarce and vulnerable herbs should be conserved under join forest management (JFM) method using local community, forest restoration, afforestation, micro propagation methods and producing large scale plant secondary metabolites (phytochemicals) through cell suspension culture methods and cryo preservations for future use. The forest ecosystem degradation and biodiversity loss are also impacted by unsustainable herbal agriculture practices, destructive harvesting in wild habitats as well as trade. Uncontrolled exploitation of forest resources to meet the demand had resulted in the extinction of many species [9]. In India rising demand burden established resources as the requirement for herbs grows and many are vulnerable. Promotion for growing medicinal plants is vital to meet potential needs [37]. There were no comprehensive reports on documentation of ethnic knowledge in the six taluks of Chitradurga district and hence, the present exhaustive ethnomedicinal survey was carried out for two years and revealed the most potential herbs used for local and surrounding community's health care needs. Medicinal flora were in use for therapy and management of various illnesses for many centuries nevertheless these plants have been poorly described without suitable indigenous information and documentation. Hence to exploit the use of these herbs, researchers need to do a thorough ethnomedicinal scientific exploration and verification of these plants for further herbal drug development [38].

Medicinal plants have become threatened species due to over-exploitation and loss of their habitats [39]. It is a great time to take effective measures to preserve these highly demanded threatened plants through the implementation of effective policies on aspects such as conservation, cultivation, capacity building, education, research, regulations, and commerce [40]. The present survey findings would offer opportunities for future herbal pharmaceutical and biotechnology researchers to develop strategies to conserve the threatened herbal species as well as to explore the opportunities for the synthesis of medicinal plants' key bioactive compounds to exploit the drug efficacy for managing and treating some of the rare and deadly diseases. A handbook is under preparation in the local language (Kannada) about the diseases treated, plants used, herbal formulations, drug preparations, dosage, and medicine applications would be published and copies of the same will be complemented to all practitioners for their reference.

Conclusion

The ethnomedicinal survey based on the traditional knowledge of the 112 practitioners belong to 105 villages from six taluks of Chitradurga district facilitated to document 190 authentic medicinal plants under 156 genera of 75 families to treat 173 diseases. The study also yielded herbal formulations for various diseases, listed the current status of certain rare and threatened medicinal plants due to climate crisis and over exploitation as observed by the local practitioners. Recommended appropriate protection measures from the government and biotechnological refurbishment approaches. Our findings laid a new foundation for future herbal drug, pharmaceutical and biotechnological researchers to emphasize the investigation of suitable herbal plants and their useful parts for the treatment of specific diseases and this database would be useful for identification of phyto therapeutic compounds as well as testing and reassuring their effectiveness for treatment and management of many diseases including development of new herbal drug molecules.

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Conflict of interest

The authors declare no conflicts of interest.

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