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Cover Photos: Above: *Hippophae rhamnoides*: A spiny shrub in fruiting from temperate regions of Ladakh. Juice of ripe fruits is anti-oxidant and does not freeze even at 0°C; Below: Flowering in *Rhododendron arboreum* in Uttrakhand - Locals prepare juice from petals which posses many medicinal properties (Photo Credits: Dr. Anil K. Goel)

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Estimating native diversity in Indian plant genetic resources vis-à-vis Ethnobotany

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Abstract

Plant genetic resources deal with the systematic use of plants for sustaining human populations; Ethnobotany, in contrast, deals with their sustainable use by traditional communities. Their common goal of estimating native diversity, that needs to be conserved, however, is realized by different procedures. The focus of this paper is on deciphering the native diversity that needs to be sustained and conserved, to the benefit of the custodians- the indigenous farmers and the local communities.

Key Words: Diversity, Native, Introduced, Crops, Crop Wild Relatives, Custodians

Introduction

Plant genetic resources (PGR) is the science of systematic collection of diversity in crops and their wild relatives, across their area of cultivation/ occurrence, estimating their distinctive characters and traits, and conserving them for present and future use. It includes the full gamut of variation in crops, semi- domesticated and wild taxa, occurring in and around farmers' fields and forest areas (Paroda and Arora 1991). Ethnobotany emphasizes the custodians of the knowledge on sustainable use of raw materials and products, either cultivated or gathered from the wild. The main point of difference is how the useful plants are used- the former for maximizing production to sustain food and nutritional requirements of the increasing population; and the latter for sustainable use of resources. The associated repertoire of procedures for survey and use and conservation, correspondingly, differ.

The discovery of the laws of genetics and evolution laid the foundations of scientific plant breeding. It also laid the foundations of PGR methods. N. I. Vavilov, referred to as the 'father of PGR' undertook systematic survey and experimental study of the diversity in relation to the geographic areas of collection, making it possible to predict and locate germplasm with desired traits (referred to Law of homologous series) and hypothesizing the centres of diversity (referred to as centres of origin by Vavilov). These were based not only on the crops and related wild species but also the agricultural practices. The need was reiterated for conserving 'primitive cultural races and of the wild relatives of our cultivated plants for plant breeding' by Baur (1914), and 'our tried and tested, still unrefined cereal landraces' by von Tschermak, 1914, (as quoted by Kilian *et al.* 2013) the foundations for conserving the germplasm. It also forms the crux of the link between PGR and ethnobotany.

The Indian region was one of the eight centres of diversity identified by Vavilov and one among the 12 megacentres of agro-biodiversity (Zeven & de Wet 1982) and was described as an area where 'a large number of wild plants are used for various purposes including food'. The Western Ghats (WG) and north eastern regions (NER) are 'hot-spot' areas of diversity (Mittermeier *et al.* 2004), and phytogeographically in part disjunct (Puri *et al.* 2017). This provides the basis for a century of survey, study, collection and use of native crop and wild germplasm from diversity- rich areas, and under traditional agriculture.

Plant genetic resources- delineating native diversity

Some questions that are relevant to this topic are- what comprises the native plant diversity? How can it be recognised as being native? What is the purpose and value of delineating the native diversity? Where are these located? A look at the crop- CWR diversity and the process of survey, screening and prioritisation of these resources provides the relevant answers.

Domesticated species of the Indian region include those in cultivation for over 4500 years like rice, about 2000 years like mung bean, and others less than 500 years old *viz.* chilli, tomato, potato. The number and diversity of crop genepools, closely related taxa including progenitor species, populations showing a crop- weed- wild continuum, and endemic species are some indicators observable in the field in native crop taxa. The crop species differ from the wild ones by a combination of morphological, ecological and physiological characters- lack of fruit shattering and dispersal of seeds; increase in size of plants, fruits and seeds; lower seed dormancy; change to annual habit; changes in breeding system often favouring self- pollination and compatibility; less defensive and protective parts; and increased susceptibility to diseases and pests (Zeven & de Wet 1982; Paroda & Arora 1991).

Fortuitous or deliberate selection for these traits of the crop plants make them more suitable for cultivation, harvesting, and human consumption, but with attendant problems of threats from pathogens. Native primitive landraces of crops with traits closer to the wild ones and CWR are a source of genes for resistance to biotic and abiotic stresses for reincorporation into crop plant through breeding programmes. Thus, the systematic collection and study of crop- CWR provide clues on - i) diversity native to the region, ii) the resource for continued improvement and adaptation of the crops, over space and time, and iii) the germplasm that needs conservation and available in traditional agricultural systems.

Wild or weedy species forms of the crop species include over 320 species which were identified as priority species for collection, use and conservation (Arora & Nayar 1984). Subsequently, prescribed standards for describing taxa, working out distributional ranges and recording uses of economic plants are in place (Biodiversity Information Standards, https://www.tdwg.org/). Crop- CWR diversity in India was interpreted using these methods (Table 1). Studies on diversity, molecular and modelling approaches for population structure, domestication, biogeography, phylogenetic analyses helped to further pinpoint priority species and areas of importance. The results for selected crop genepools of native legumes and millets are given below as examples.

Mung bean, a crop of Asiatic *Vigna* group in India: Mung bean (*Vigna radiata* (L.) R. Wilczek) is one of the five crops of Asiatic *Vigna* group, subgenus *Ceratotropis*, with the widest range of cultivation in tropics, subtropics and temperate parts, whereas its related wild form, *V. radiata* var. *sublobata* (Roxb.) Verdc., is a scrambling annual or perennial of seasonally dry tropical areas- from the Indian region to Australia on the east and Africa and Madagascar on the west (POWO; GBIF). It shows a wide range of differences in plant habit (indeterminate and viny to erect types), seeds large to small ones (closer to the wild), colour, taste and use (cream coloured 'Sona mung', used in eastern India in ceremonies). 'Out- of- India' events were worked out by Ong *et al.* (2023) through use of molecular data for model-based population structure interpretation, and estimates of ancestry and migration events. The crop moved from South Asia, to South East Asia, then to East Asia and subsequently to Central Asia; Geeta and Nayar (2023) found that this interpretation was substantiated by the archaeological findings.

Mung bean and its relatives exemplify significant features typical of a crop important in traditional farming areas and indigenous communities- 1) The group is preadapted for domestication, having major crop species (Urid, Moth, Adzuki bean), and underutilized one (Rice bean), each with related wild forms; 2) Wild species have edible seeds: in wild mung and *V. sahyadriana* Aitawade, K.V. Bhat & S.R.Yadav in WG and north western hills (pers. observ. and pers. comm., Dr. K.V. Bhat, NBPGR); those of *V. trilobata* (L.) Verdc. and *V. stipulacea* (Lam.) Kuntze, the wild- weedy combination, are gathered by the farmers (pers. comm., Dr. Kamala Venkateswaran, NBPGR); 3) Endemic species include *V. khandalensis* (Santapau) Sundararagh. & Wadhwa., with largest plants and seeds in the group, occurring at higher altitudes of WG, and *V. hainiana* Babu, Gopin. & S.K. Sharma, with small seeds, indigenous at lower altitudes (pers. observ.); 4) High diversity in WG, was represented by several hitherto unknown or unidentified taxa/ species, most notoriously difficult to distinguish.

Wild relatives of crop plants in India: diversity and distribution: Examples of analysis of diversity distribution (methods described in Table 1) are presented below- one of millet crops, with large number of species; and the other, of the legume, *Cajanus*, with high diversity in India (> 50%).

Millets of Tribe Paniceae are represented by native taxa in six genera- Browntop millet (*Urochloa ramosa* (L.) T.Nguyen), 'Sawa' (*Echinochloa colonum* (L.) Link), 'Kodo' (*Paspalum scrobiculatum* L.), Yellow foxtail (*Setaria pumila* (Poir.) Roem. & Schult.); Little millet (*Panicum sumatrense* Roth) and 'Raishan' (*Digitaria compacta* (Roth) Veldkamp). Sixteen species (and 4 endemics) out of over 100 species were selected as CWR. Diversity is represented as a wild-weedy-cultivated continuum in all.

Cajanus, with over 35 species of tropical and subtropical regions and habit, ranging from erect to shrubby and creeping, had a secondary build-up of species (14) in the Australian region. 'Toor'/ 'arhar' (*Cajanus cajan* (L.) Huth), is native of the Indian region, and widely cultivated as annual/ perennial,

except in north eastern plains, for local medicinal use (pers. comm., Dr. K. C. Bhatt). Diversity in CWR was maximum in the WG followed by NER (3). Endemic species, however, were in the Eastern Ghats and adjacent regions.

Significant trends noted for crops and CWR across these groups/ taxa are given below:

i. Priority species determined in large genera-16/100 species of millets selected; biosystematic study, globally, included few native taxa. *Cajanus* and Asiatic *Vigna*, in contrast to the millets, are medium- sized genera (<40 species).

ii. Region- specific differences- cultivation in the Indian region versus gathering in Africa of 'Kodo' and 'Sama' millets; resistance to pests in *Cajanus*, was less in species predominantly native to India as compared to those groups predominantly represented in Australia.

iii. Hot- spot areas- WG and NER were areas with maximum species diversity for the seven genera of millets analysed (except *Setaria*); high variability and diversity in forms in Asiatic *Vigna* was noted by Dr. Arora (pers. comm.), later described as new species (6 new species were described in the last few decades).

iv. Endemics- These show diversity build- up both within the diversity hot- spot areas, as well as out of it- in eastern parts for *Cajanus* (3), and all over for *Vigna* (1).

v. Diversity- rich taxa- Wild form of mung bean, in Australia, was different from its South Asian counterpart. This trend of high diversity build- up (called latitudinal diversity gradient by Brown 2014) appears to be characteristic of both the crop (described above for mung bean) and wild taxa of Asiatic *Vigna*.

vi. Host- pathogen- vector combination- Mung bean (host)- for Yellow Mosaic Disease and its strains (pathogen), causing serious losses - and white fly (vector) were native to the region.

vii. Taxonomy and classification- CWR exhibit a difference in altitudinal preferences, of sections in Asiatic *Vigna*, and among species within a section in *Cajanus*.

Table 1: Parameters for analysing diversity in CWR[2] within crop genera

S. No.	Parameters	Diversity patterns identified
1	Species in India vs. total species[3,4]	Over 50 percent of species native in the Indian region (20 genera- *viz*. *Cajanus*)
2	Distributional ranges	Species distribution ranges classed (total distribution vs. distribution in Indian region)- a) tropical conditions- Indian subcontinent, Asian tropical, African- Asian tropical; b) in temperate conditions- Asian temperate; c) occurring across tropical and temperate regions- Asian and African- Asian; and d) maximum widespread- Asian- European/ pantropical. Distribution within India- North Western Plains (NWP) And Hills (NWH); Central India (CI), Eastern Plains (EP), North Eastern India (NEI), Peninsular India (PI), and southern India (SI and extendable Sri Lanka, SL).
3	Potential areas of resistance to stresses	
i	Crop/ wild species- areas of availability	Major areas of cultivation were- North Western Plains (NWP) And Hills (NWH); Central India (CI), Eastern Plains (EP), North Eastern India (NEI), Peninsular India (PI), and southern India (SI and extendable Sri Lanka, SL).
ii	Areas of prevalence of diseases/ pests	Biotic stresses classed as- fungal (F), insect pests (I), nematodes (N), viruses (V); weediness was also considered a part of biotic stress (W). For abiotic stresses, data available was limited to extremes of temperature and precipitation and salinity.
4	Nomenclatural check of native species[1-5]	Name changes noted (since[1]), checked against monographic works and global databases, to work out the justification for suggested name changes in native plants, a) from the taxonomic viewpoint; b) as PGR.

Arora and Nayar (1984)[1]; Nayar (2018)[2]; Pradheep *et al.* (2014)[3]; and e- floras/ floras[4]; e- databases: POWO, WCSP and GBIF, IPNI[5]

PGR data relevant for ethnobotanical study in the Indian region

Fuller (2011), discussing domestication in South Asia comments on the clear evidence 'for emergence of sedentary village societies that are invariably dependent on cultivation and usually have domesticated crops and livestock'. With the tradition of use of plants for healing and maintaining health, ethnobotanical studies, often intersect and provide crucial support to the work on native PGR:

Delineate infraspecific variants: *Landraces* of native crops are predictably an important part of traditional and subsistence farming systems *viz*. indeterminate forms of legumes, which have practically disappeared from farmers' fields; *semi-domesticates/ wild species* of the wild- weedy- crop continuum *viz*. weedy *Vigna stipulacea* is a potential domesticate.

Collect and maintain desirable types: Propagules and plants for voucher herbarium specimens are not simultaneously available in PGR work; for newly collected/ introduced material, study of experimentally raised plants were the source of material and information for addition to the wealth of India (pers. comm., Mrs. Kamala Chandran, former in- charge, Wealth of India Section, CSIR, New Delhi), and for study of the genetic basis of the observed diversity.

Quantification for conservation: Patterns of distribution of traits in closely similar groups of species has predictive value *viz*. in EP for *Cajanus*- endemic species of three sections are represented but with different altitudinal preferences; this is also the source area of the crop- wild progenitor species (*C. cajan- C. cajanifolia* (Haines) Maesen), reported to be inter-crossable and giving intermediate types. Overlaying trends for other crops/ categories using over 400 CWR of vegetables, tubers, fruits, spices, multi- use plants provide a reference profile for locating and collecting indigenous diversity.

Back to the traditional custodians: *Buchanania lanzan* Spreng., a minor fruit and oil seed plant is a recalcitrant species (seeds lose viability on drying); young fruits with lower oil content, however, did better during transport from the field to the laboratory. The value of not stripping trees of all ripe and maturing fruits was shared with the local users to encourage natural regeneration (pers. comm. Dr. N. S. Panwar, NBPGR). Community genebanks, and other on-farm measures (*viz*. https://alliance.indiaagrobdunepproject.cgiar.org/) protect and promote the 'our tried and tested, still unrefined 'landraces'.

Nomenclature: A word of caution- Dr. M.P. Nayar (former Director, BSI) emphasized re- checking before accepting a name change (pers. comm.); through nomenclatural study (Nayar & Bhardwaj 2023) of the native endemic taxon of WG, *Nesphostyles bracteata* (Baker) D. Potter & J. J. Doyle, incorrectly merged into the crop species, *Lablab purpureus* (L.) Sweet, was reinstated.

Dr. S. K. Jain recognised early on the inextricable connection between Ethnobotany and PGR, and the need for collaboration to mutual benefit (Jain 1988). His suggestion when dealing with the complex and multifaceted problem was to split the work to small and easy-to-study issues, and the study of ethnobotany and PGR qualify for this approach.

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Ethnobotany: What next in India?

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Abstract

Ethnobotany is a storehouse and testament as well as the manifestation of the most valuable indigenous knowledge based information system owned by the indigenous communities all over the world. Indian sub-continent has a very rich corpus of the ethnic as well as the plant diversity comprising an ideal hot spot for the ethnobotanical studies. Ethnobotany is ever expanding and rewarding discipline during the past six-seven decades in India generating extensive inventories of the medicinal, food, and cultural plant uses and now a well established domain having limitless possibilities and R&D opportunities for the bio-prospection. However, in a rapidly changing socio-ecological context, it is facing the challenge of redefining its direction. In this article, the emerging priorities for ethnobotanical research in India and some significant future guidelines have been proposed and discussed in detail. It is suggested that integration of Ethnobotany with modern science and application of the digital tools in an ethical framework is required to accomplish its conservation, continual development and judicious exploitation for the posterity and the mankind. Besides, emphasis should be given to strengthen the collaborations between scientific institutions and the stake knowledge holders, ensuring knowledge sovereignty, and translating ethnobotanical insights into product, policy and practice for the sustainable development.

Key Words: Cultural Ethnobotany, Material Ethnobotany, Nutraceuticals, Bio-prospection

Ethnobotany is a highly versatile and innovative discipline. It is the most appropriate tool for unleashing and reclaiming the power of ancient wisdom owned by the indigenous communities to the world since the time immemorial. The simplest one line definition of *Ethnobotany is: The scientific study of man-plant relationships* (Jain and Jain 2017). Indian sub-continent harboring more than 750 tribal communities as well as over 50,000 plant species distributed in nine phyto-geographical regions comprise the most ideal place for pursuing the ethnobotanical studies.

Documentation of Ethnobotanical Knowledge (EBK) in a scientific manner started almost six to seven decades ago in India. Padmshree Dr. E.K. Janaki Ammal pioneered to lit-up the lamp of ethnobotanical studies in India during 1950's. Ethnobotany started developing to the leaps and bounds during 1960 under the leadership as well as mentor-ship of late Dr. S.K. Jain, renowned as the Father of Indian Ethnobotany.

With the sustained, seamless, compassionate, relentless efforts and contributions of the various acclaimed ethnobotanists, this core discipline steadily developed in a scientific manner along with several new dimensions and milestones (Jain & Jain 2015; Jain & Jain 2016; Jain & Jain 2020; Goel 2019). *All India Coordinated Project on Ethnobiology* (AICRPE) launched during 1982 by the then Ministry of Environment and Forests, Govt. of India, New Delhi involving various research organizations all over the country, had been very successful for documenting the ethnobiological information from the field. Ethnobotanical researches in India have played a crucial role in understanding and unleashing the intricate interactions/relations between the people and plants, researching the wide spectrum of traditional knowledge, and promoting sustainable utilization of the plant resources for the benefit of the human-beings to mitigate their sufferings.

Khan (2005) had excellently elaborated for the need to give more emphasis about the studies on Ethnobotanical/Tra-

ditional Knowledge Hot-spots in India having 30% tribal population as well as 33% forest cover. In the current scenario, there is a need to introspect and find out and identify the gaps to be fulfilled and to adopt and pursue the emerging new qualitative and quantitative dimensions of Ethnobotany (Prance 2021) and work accordingly in a more coherent and flexible manner to unfold the treasure of EBK through bio-prospection and adopting the inter-disciplinary approaches as well as by applying cutting edge technologies.

Ethnobotanical knowledge should be judiciously utilized towards the conservation of plant resources and to somehow avert the climate change as faced by the world today (Takubessi *et al*. 2025). In order to keep this discipline in the forefront and propulsion mode, some thought provoking future strategies and milestones of research work to be carried out/pursued and emphasized in the field of Ethnobotany in our country have been discussed and elaborated under the following two main heads, *viz*.: **Cultural and Material Ethnobotany.**

A. Proposed research aspects on Cultural Ethnobotany

1. There are fewer reports on plants used in the worship, festivals, various social ceremonies, birth/death/marriage rituals, weather forecasting etc. (Kunwar *et al*. 2021) Similarly, plants mentioned in the folk-lore, folk songs, folk tales, ballads, riddles, tribal legends, proverbs, idioms, local names, clan names, paintings, art and craft should be carefully studied, documented and reported systematically tribe- or region- wise. In order to reduce over exploitation of medicinal plant species, ethnobotanical studies should be done linking with sacred groves and the beliefs, totems and taboos of the indigenous communities and cultural landscapes. For the conservation of forests and natural resources, some other aspects for example, deeper insight on the weather forecasting through plants done by the indigenous communities could be carried out intensively. Such kind of planned and logical studies can help in resolving several issues pertaining to the present day climate crisis and better management of the associated challenges.
2. To document the plant names in local languages and try to find out the etymology of those local names and the tribal clans. This will help in the preservation of native dialects/languages as well as give insight into how plant names have been created during the course of time among various ethnic and indigenous clans/communities all over the country. It will be worthwhile to mention here that many botanical epithets in the Latin binomials have been taken from the tribal/ local names viz.: *Terminalia catappa,* where *catappa* comes from Malayan name 'Ketapang'.

Local students at the high school and intermediate levels can be of utmost help in the documentation of indigenous knowledge discussed under the above two points. In order to achieve this, documentation of above knowledge should be the part of their educational curriculum. For the conservation of this knowledge, the state and the central education boards should come forward to incorporate these topics in their curricula in the form of small field projects.

B. Proposed research aspects on Material Ethnobotany

1. To explore the various dimensions of Need-based Man-Plant relationships such as plant species used as indigenous diversity of food, fodder, fencing, fibre, fuel, agricultural tools and implements, medicine etc. Moreover, the comparison with the earlier reports on same aspect could be highly useful in finding out the addition or deletion of EBK in that region during the course of time.
2. Very little work has been done on the documentation of ethnobotanical knowledge on the lower groups of plants (non-flowering/cryptogams) including fungi and symbiotic associations such as lichen, hence; need special attention and prioritization by the ethnobotanists/researchers.
3. To carry out 'Tribe specific' ethnobotanical studies in a particular region to create a comprehensive database on that tribe or community. Such kind of databases could be created all over the country and after digitization, could be stored on a website and made accessible for the researchers who wish to pursue further research work in Ethnobotany. This will also help in preventing plagiarism and pseudo-ethnobotanical practices. Basically, community-led ethnobotanical studies could be pursued with a motto of research *with* communities, not *on* communities.
4. To find out the areas whose EBK was documented four to six decades ago and again undertake the ethnobotanical surveys in those regions to ascertain the conservation or loss of the documented knowledge. Moreover, to compare the present Ethnobotanical knowledge with the past one of that region would be of utmost importance to find out the dynamism in EBK in form of the gain or loss in EBK.
5. Herbaria also play a very crucial and vital role in pursuing the ethnobotanical studies; specifically over 100-250 years old herbarium specimens which have ethnobotanical information. After revisiting the documented regions of ethnobotanical information, such data may be re-validated and can be used in the assessment of existing ethnobotanical knowledge. Similarly, comparative analysis of the ethnobotanical studies undertaken during the British era and published in several old floras

and unpublished reports/field books can also be consulted and reviewed to ascertain after a century as what changes have taken place in the then recorded ethnobotanical information whether it has been further enriched or eroded with the time and pace due to overall developmental activities (Shinde & Prakash 2015).

6. To carry out urban ethnobotanical studies in the areas displaying pluriculture. This is utmost important in the current situation when cities/towns are rapidly expanding and advancing under the impact of fast urbanization and continuous migration processes and hybridization of ethnobotanical/traditional knowledge has been going on steadily (Prance 2021). The workforce generally comes from the far off tribal and rural areas to the cities and impacts the botanical knowledge through various means which needs to be judiciously explored.

7. To take up cross-cultural ethnobotanical studies among the far distant regions or distantly living tribes and assess the credibility of folk claims as well as describe the process of evolution from the obtained results.

8. Nearly 5% of the 3,70,000 known species of world flora are edible and 75% of the world's food is generated from only 12 species of plants and 5 species of animals. Lots of less known plants species are used as vegetables, fruits, agri-crops by the tribal/indigenous and village communities in our country. Research and documentation of such less known wild fruit and vegetable species may be taken-up on the top most priority to unfold the presence of rare minerals and vitamins for value-addition. Research could be focused particularly on climate-resilient traditional crops and wild edibles. It would help in unveiling the infinite possibilities of the food fortification and development of various nutraceuticals. Moreover, impact of the Biological Diversity (Amendment) Bill-2021, recently passed by the parliament about indigenous knowledge and bio-prospection studies must be reviewed carefully for research and conservation of the ethnic resources.

9. Documentation of ethno-agricultural practices by the tribal/indigenous communities should also be assigned priority. Publications based on the ethnic cultivars of the crops practised by the tribal and rural people with their economic, medicinal as well as nutraceutical potential will be very significant. Comparative analysis of the nutritional contents in the ethnic crop cultivars as well as the commercial cultivars may divulge the interesting findings and novel lead molecules/genes. The indigenous or endemic cultivars may also offer some unique traits useful for the breeding and crop improvement programmes in the fast climate changes world over. Such success stories may also be published for the information of the scientific community as well as the young workers. The ethnic cultivars may also be registered with the *Protection of Plant Varieties and Farmers' Rights Authority* (PPVFRA), Ministry of Agriculture, New Delhi to safeguard the ownership rights. Emphasis has to be laid about the R&D studies on ethno-biological control of insects and pests in tribal agricultural system. Innovative research projects on the development of the agro-technologies of potential ethno-crop plants as well as ethnomedicinal plants should be crafted. It will also reduce the pressure on wild plant species and also encourage their commercial cultivation for getting the quality material by involving the indigenous people for their financial upliftment.

10. Documentation of traditional knowledge related to various ethnic food recipes spread across the country will be useful to develop a gastronomic tourist circuit. The showcasing of food culture and tradition will indeed help in highlighting the particular region and further help in social and economic empowerment of the indigenous/local communities (Jain 2021; Shah 2025). Similarly, very little information has been documented about the ethnic fermentation processes. Lot of work has to be done on the ethno-probiotics among the tribal/indigenous communities for the purpose of bio-prospection and industrial use.

11. To find out the plant species of high importance among the tribal/ethnic communities and to suggest the ways such as the value addition techniques through which those plant species could be utilized to enhance the income of the local masses through their organized cultivation. Even cottage industries including the tribal artifacts, handicrafts could be developed based on that particular EBK. Regular survey and documentation of the tribal markets in the interior faraway localities is also very important. Visibility of the Indian tribal artifacts in the national and international markets is almost negligible in our country. *Tribal Cooperative Marketing Development Federation of India* (TRIFED), New Delhi should come forward and take more active lead in the right direction so that the tribal communities are benefited in reality.

12. Establishment of the ethnobotanical museums (collection of plant parts, tribal art and craft items, musical instruments, tools, implements and the utensils etc.) in the nearest University or College as well as the institutions and to regularly conduct the educational tours and exhibitions to the museum for the students and the other interested people to make them aware about the rich indigenous wealth of their regions. The local students can help immensely in development of these museums/exhibitions.

13. Assessment of the credibility of folk medicinal claims is an important aspect which needs to be carefully pursued and carried out with appropriate methodologies for example, use of quantitative ethnobotanical indices such as use-value index, informant consensus factor, cultural value index etc. Judicious use of statistics in the data collection, assimilation and analysis as well as the representation is necessary which can enhance the impact and quality of publications in Ethnobotany as per the international standards (Khan 2005).

14. To find out the chemically less explored plant species having high credibility towards a particular ailment and then initiating scientific validation of the medicinal property of a plant species by applying the various standard phytochemical, pharmacological and molecular techniques and methodologies including Genomics and Metabolomics. There is an urgent need of crafting well designed multi-disciplinary/institutional research projects by involving specialists for harnessing the benefits of scientific validation, drug discovery, safety aspects as well as the value addition through bio-prospection. But the interests of the stake holders should be attributed the top most priority for benefit sharing (Goel 2019). Success stories of the product development from the ethnic leads as well as the IPR related issues must be reported on the priority basis. Training courses could be organized frequently by the Ministry of AYUSH for the Ethnobotanists to familiarize with the patent application process, widen the scope of access and benefit sharing with the indigenous/local communities.

15. To find out the local uses of the invasive plant species growing in a region as well as its impact on economy, and the impact on the usefulness of the indigenous flora among the native communities.

16. Exploration of historical architecture could also be very useful in unfolding the evolutionary aspects of plant species and their association with man.

17. There has been a strong need to locate and pinpoint the major ethnobotanical hot spots in the various phyto-geographical regions of the country which may be prioritized for the fast track research and documentation programmes. In this regard, GIS mapping of ethnobotanical resources will be very helpful.

18. Digitization of the medicine men/informants among the tribal/indigenous communities has not been initiated till date. A very little work has been done in this direction in the Jharkhand region. Studies/research projects on this aspect must be taken-up on priority basis. All such digitized local medicine men (AYUSH practitioners) and stake holders may be encouraged to practice as well as access their biological resources in their localities. Emphasis should be given to deter digital biopiracy and data sovereignty of indigenous groups should also be ensured. These generated digital foot prints will be very useful and helpful in the preparation of PBRs **(Peoples Biodiversity Registers)** as well. The state biodiversity boards may grant research projects in this direction to achieve the desirable goals.

19. In the current era of Artificial Intelligence (AI), pattern analysis in traditional formulations, plant use across cultures and regions, transcribing and analyzing oral traditions, tracking of intellectual property, organizing ethnobotanical data in digital knowledge repositories etc. using various AI tools could be very helpful.

Conclusion

With the development and expansion of Ethnobotany all over the world as well as in our country, researchers have found that the circumference of ethnobotanical knowledge has no boundaries and sky is the limit for its further expansion through the ingenious innovations. R&D studies on its all sub-disciplines will help in the development of Ethnobotany in the horizontal direction while the multi-disciplinary and multi-institutional aspects leading to the value addition will help its core development in the vertical direction. It will also support in crafting the visionary document of Ethnobotany for realizing and unfolding the multiple facets of indigenous intelligence, wisdom and the talent of indigenous communities.

Research on several new/interesting facets of Ethnobotany is possible (Balick 1996; Vandebroek *et al.* 2020). Cox (2005) has narrated very lucidly about the seven pillars of ethnomedicinal wisdom. There are many more ethnobotanical aspects which are waiting to be explored by the budding scholars researching in the field of Ethnobotany; for example, longitudinal studies on how EBK is changing with urbanization and climate stress need to be done. However, the first thing is that scholars must first conceptualize and pinpoint clearly on the subject Ethnobotany and then start conducting the research ethically using the methodologies specified for such research work (Jain & Jain 2017). The knowledge about quantitative ethnobotanical tools and their applications is also must to prevent the pseudo-ethnobotanical practices (Jain 2023). Moreover, the prerequisite of obtaining prior informed consent and the process of benefit sharing as per Article 8 (j) of the **Convention on Biological Diversity (CBD)** among the communities or the stake holders as well as the patents, know-how etc. should be clearly understood/documented and followed accordingly in the letter and spirit of CBD. Basically, all ethnobotanical researches should be carried out in a proper ethical framework and knowledge holders should get access to benefits arising from such research work. Efforts should be made on applying EBK for

socio-economic welfare of the local communities and overall humanity worldwide (Prakash 2022).

By applying cutting edge insights in Ethnobotany, well-crafted research projects and the research papers based on quantitative and qualitative aspects should be pursued logistically with multi-disciplinary approaches in a collaborative and coherent manner to unveil its infinite benefits. Establishment of a 'National Institute of Ethnomedicine' for the validation of highly potential ethnomedicinal claims is the need of the hour for serving the mankind. It will certainly add the newer products to the pharmaceutical as well the nutraceutical sectors by creating more R&D opportunities for the researchers, help the youngsters in new startups, creating more jobs and the economic and social empowerment of the tribal/indigenous communities. The well-planned researches in the area of Ethnobotany with multi-institutional approaches will help to accomplish, revitalize/reinvent and promote sustainability for nature and mankind and also towards the development of resource-efficient circular economy. For the conservation and continual development of the subject Ethnobotany, the discipline must be included in the curricula at graduation and post-graduation levels in all the Universities in our country. There is also a need of organizing interdisciplinary capacity-building trainings for researchers persuing in Ethnobotany linking subjects such as biology, anthropology and law.

The points highlighted above can serve as a vision document for at least one decade in Ethnobotany. Multidimensional ethnobotanical knowledge could be rewarding by transforming and realizing its potential into prosperity, obstacles into opportunities and the aspirations in to great achievements for the researchers by in-carving innovative research projects. The research projects in the area of Ethnobotany should be supported by all the state and central funding bodies so that more researchers come forward to pursue the R&D studies. Ethnobotany has limitless possibilities and a vast spectrum of knowledge. Overall, future of Ethnobotany in India should be lined up as ethics over extraction, integration over isolation, and community empowerment over academic ownership.

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Ethnobotanical note on *Urtica dioica* L.: An immune-modulatory antiviral herb and its value added products

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Abstract

Since the onset of human civilization, plants were widely used as a raw or in the form of cooked food, vegetables, soup, medicine and so many other traditional recipes. It is also believed that, the herbal remedies are safer to use and have no or lesser side effects as compared to allopathic medicines. *Urtica dioica* L., belongs to family Urticaceae, locally known as *Shisoon,* is commonly used as vegetable in Uttarakhand, and known to attribute immune stimulating, antioxidant, anti-inflammatory, anticancer and anti-viral properties. Traditionally, the herb is well known for the treatment of several ailments like arthritis, joints pain, etc. The dried tender leaves are used as soup and tea for boosting the immunity during throat infection. In ancient socio-cultural activities, the plant was usually applied for the punishable offends in their societies. This article deals with ethnobotanical updates of *U. dioica* focusing on anti-viral, anti-inflammatory, immune-modulatory, traditional recipes and its uses in ancient socio-cultural activities etc.

Key Words: *Urtica dioica*, Stinging nettle, Wild vegetable, Anti-arthritis, Ethno-pharmacology, SARS-CoV.

Introduction

Plants are well known to contain several chemical substances known as primary metabolites and secondary metabolites such as alkaloids, tannins, flavonoids, steroids and phenolic compounds and each metabolite have a definite physiological role and action on the human body (Amin *et al.* 2013). Phytochemical analysis revealed that the secondary metabolites present in the plants have proven their potential role in several therapeutic applications such as immune-stimulating, resistance building, anti-oxidant, anti-inflammatory, anti-retroviral etc. and played very important functional role as a preventive measure to control pandemics caused by viruses (Jahan & Ahmet 2020). Since the onset of human civilization, traditional medicinal plants have become essential commodities as food, vegetables and healthcare products. About 75-80 % of the world population, mainly in developing countries rely on botanical drugs due to their lesser side effects and socio-cultural acceptability and compatibility with human body (Anonymous 2019; Vinha *et al.* 2012). Chinese and Indian traditional medicines were considered as one of the oldest elements that have an important role in world healthcare system (Guo *et al.* 2020). These traditional components comprise Ayurveda, Unani, Siddha, Yoga, Naturopathy, and Homeopathy and are efficiently practiced all over the country for curing various infections and ailments.

U. dioica L., Urticaceae; (Stinging nettle) is locally known as *Shisoon, Bichu gash* in Kumaon, *Kandali*, & *Shisoon* in Garhwal, *Bichchu butti* in Hindi and Panjabi, *Vrishchhiyaa-shaaka* in Sanskrit and *Anjuraa* in Unani. It is a Perennial, erect robust herb or shrub, 0.5 to 3.5 m high, stem branched from the base; bark fibres, petiole, leaves and stem covered with sharp irritating stringing hairs. Leaves ovate, lineolate, acuminate, base rounded or cordate (Figure 1). Flowers small, pale green, on long and tassel like, drooping or spreading 2-10 cm long, paniculate cymes, usually male and female are on different cymes or plant. Male flower with 4-perianth segments; 4 stamens. Female flowers contains female parent segments-4, unequal, or sub-orbicular, shining light brown, enclosed by persistent perianth. Flowering and fruiting generally occur during August to April.

The genus name "*Urtica*" comes from the Latin word "*Uro*" meaning to burn. 'Nettle' comes from the Anglo-Saxon word, referring to the sharp stings or the use of the fibrous nettle stems in cloth making (Kavalali 2003). Globally, the plant is wildly distributed throughout the temperate and tropical areas, but very common in Europe, North America, North Africa, and Asia (Bhusal *et al.* 2022). The genus comprises about 50 species all over the world. However, 4-5 species are reported from India and distributed from Kashmir to Kumaon Himalayas (Gaur 1999) at altitudes of about 2,100-3,200 M. Of them, *U. ardens* Link (Synonym: *U. parviflora*); *U. dioica* L. and *U. urens* L. are reported from Uttarakhand Himalaya and commonly grow on foot path, road side, crop fields, dump soil, river bank etc. All the species are perennial fibrous herbs or undershrub and covered with sharp stinging hairs.

Fig. 1: *Urtica dioica* L. (Stinging nettle)

In Uttarakhand Himalayas, *U. dioica* is commonly used as vegetable, soup, tea and to treat joints pain, arthritis, throat infection etc. Moreover, several high valued herbal tea products have been commercialized in national and international markets (Website 1 & 2). *U. dioica* has been considered as an extraordinary vegetable and believed to be a galactogogue with diverse functions including, stimulation of digestive system, treatment of diabetes, diuretic and having significant antimicrobial and antioxidant activities (Upton 2013; Bisht *et al.* 2012; Das *et al.* 2011; Krivenko *et al.* 1989). Furthermore, the leaf of this plant is known to be a rich source of iron, minerals, vitamins B_1, B_2, B_3, B_6, and various kinds of human health beneficial bioactive phenolic and polyphenolic compounds (Durovic *et al.* 2017; Sasa *et al.* 2024). Despite, its multi-functional application, the full pharmaceutical potential is yet to be investigated.

This article was aimed to collect and document information on traditional uses of *U. dioica* focusing on its anti-viral, anti-arthritis, anti-inflammatory, immune modulatory properties pertaining with its importance in socio-economic and socio-cultural practices. It is anticipated that the results discussed in this study will provide the basis of further pharmacological and phytochemical investigations to find out some potential drug candidates which can be applied at any critical situation or viral pandemics.

Materials and methods

The present study was undertaken in two parts. The first part of the study was conducted during 2018-2019 (before COVID-19) on a plant samples collection tour of CSIR-Central Drug Institute, Lucknow, under National Phyto-pharmaceutical Mission project. A total number of 80 male and female participants aged of about 50-80 years old (20 from each districts) were randomly selected (Table 1 & Figure 2, A-I) from Almora, Bageshwar, Nainital (Kumaon region) and Chamoli (Garhwal region), Uttarakhand (Figure 3 A-D). The selection of study areas was based on urban, semi-urban (Nainital and Almora) and remote areas of ethnic communities (Bageshwar and Chamoli). The information for documentation were focused mainly on folk-traditional uses of *U. dioica* for food or for treatment of joints pain, arthritis, anti-inflammatory, air borne/viral infection and use in ancient socio-cultural activities etc. Further, the collected information were compared with each districts for their cross verification. While, the second part of the study comprises a comprehensive literature survey using Google Scholar, PMC, PubMed and various Websites etc. The literature survey was mainly focussed on its known phytochemical constituents, biological activities on anti-viral, anti-inflammatory, immune modulatory etc. However, the details of marketed products concerned with human health benefits were obtained from the various other website sources (Websites 1 & 2). Furthermore, the collected information from all the study areas were correlated with the published scientific data to justify these traditional claims.

Ethnobotanical uses

Juvenile leaves and twigs of the plant (Figure 4) were collected and dipped in boiled water and then cooked for 30 to 45 minutes in an iron pan and then ground to prepare semi-solid paste for making delicious green vegetable. The properties of this vegetable are known to be hot and it is advised to not to give to the pregnant women to prevent their conceived pregnancy. The dried leaves are used to prepare hot soup and tea during extreme winter to warm-up the body and boost-up immunity as well as to reduce congestion of nose and throat during viral infection. Similar kinds of traditional uses reported earlier from other countries like Scandinavia, Iran, Eastern Europe, Native America etc. (Website 3) attest and authenticate our observations reported in this paper. However, stem is locally applied to facilitate urination and easy delivery at the time of pregnancy.

Fig. 2: Randomly selected informants during ethno-botanical survey: A, B, C, & E- Bageshwar district, Uttarakhand; E, F & G - Chamoli district; H & I -Almora district

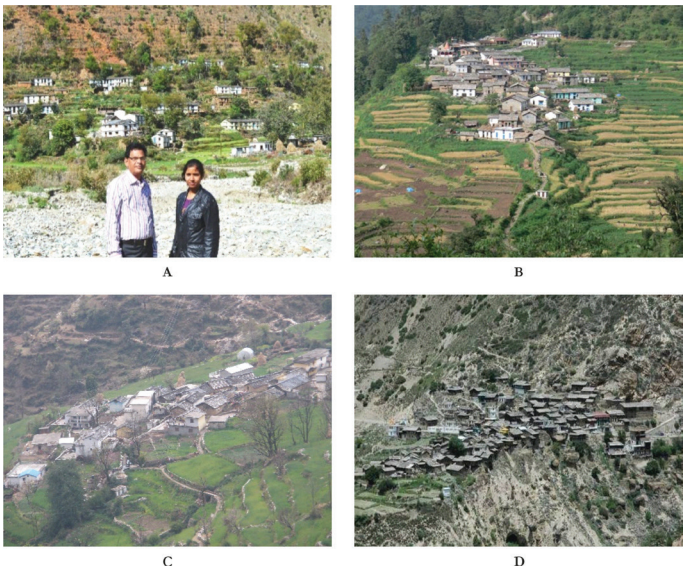

Fig. 3: Ethnobotanical study locations (districts) of Uttarakhand:- A-Almora, B & C- Bageshwar, D-Chamoli

Fig. 4: *U. dioica* plant

The plant is externally used in rural and tribal areas of Almora, Nainital, Bageshwar and Chamoli districts for the treatment of joint pain, arthritis and as anti-inflammatory in case of external injuries. The scientific mechanism of action is not clear, but it is presumed that the plant has stinging trichome containing acetylcholine, formic acid, 5-hydroxytryptamine (serotonin) and histamine (Khere 2004; Fu *et al.* 2006). When it is applied locally on the affected parts of the body, the trichome act as hypodermic needles and inject histamine and other phytochemicals into the body and create acute blistering on the whole body. As long as its effect remain in the body, the neuro-signal transmission of the brain concentrate only to sense the acute blistering sensation and patients get relief from the pain. During interrogation with the participants, particularly in rural and tribal locations of Almora, Bageshwar and Chamoli districts, it was also came into the notice that, when the parents take away to their small babies (below the age of about 4 years) outside their home for treatment or by the means of any other reasons, they used to take a bunch of stinging nettle twigs in their hand and keep moving around the face of the babies to prevent them from any kinds of air borne diseases or /may be viral infection. Such kind of local believes and practices strongly indicate towards its strong anti-viral properties.

Ancient socio-cultural activities of Stinging nettle

The plant species is also known for its interesting historical and folk traditional uses during ancient socio-cultural activities of Kumaon and Garhwal Himalayas. The plant species contain very sharp and irritating stinging trichomes in its leaves and stem parts. When the human beings or animal come into the physical contact of this plant, these sharp stinging trichomes have a tendency to enter quickly into the body and release these phytochemicals and creates very intolerable irritation in whole body just like burning and poisoning of scorpion sting. Due to such kinds of painful physical and chemical reaction, the ancient people used this plant in their socio-cultural activities to punish the accused person and children for their punishable offences. The above facts were also confirmed and verified by the author's parents. In this process, the wet plant was used to stroke several times around the necked body of the accused before the 5 constituted village level judiciary members (locally known as *Panch*) and the party members from both the sides and the unanimous decision of the *panch* used to announce to accused. However, due to increasing rate of literacy among all the societies and availability and awareness of local level Government judiciary system, this practice was gradually shutdown and now almost stopped.

The stem of this genus contain very soft fibres. The mature stem (Figure 5 A) of the plants was harvested, dried and

Fig. 5: A- Mature fibrous stem of *U. dioica* used as raw materials for processing and making fine threads, B-Rope prepared from the processed fibres of *U. dioica*

kept under water ponds or river for 1-2 months and then the fibres peeled out from the stem. The peeled fibres were collected and washed thoroughly in running water. In this process, the collected fibres turn to soft and shining. Then the raw materials were weaved to make fine threads (Figure 5 B) and then used to make several handicraft items such as garments, mats, and interior decorative items as well as several traditionally used agricultural items etc.

Pharmacological activities

Scientific investigations on this plant published in reputed journals reveals several pharmacological activities such as antioxidant, antimicrobial, anti-inflammatory, anticancer, antiulcer, analgesic (Alimoddin *et al.* 2024), and medicament against anemia, gout, eczema, urinary, bladder, and kidney problems (Orcic *et al.* 2014; Pinelli *et al.* 2008). It has also shown to control extreme menstrual bleeding, haemoglobin and haematocrit after child birth and helping in reducing postpartum haemorrhage (Fatemah *et al.* 2024). Jain (1991) reported that the plant contain several other ethnomedicinal properties for treatment of boils, wounds, gout, rheumatism, jaundice, throat disorders etc. While Joshi *et al.* (2014) revealed to possess as anti-colitis, antiviral, anticancer, antibacterial, antifungal, anti-androgenic, insecticide, immune-modulatory, hypocholesterolemic, hypoglycaemic, cardiovascular effects, natriuretic, hypotensive, hepato-protective, and anti-arthritis properties. Infusion of leaves showed anti-dandruff, expectorant and blood purifier activities (Khere 2004; Mocon *et al.* 2016). Simultaneously, the plant is also used as a part of many dishes such as soups, omelettes, noodles, salads (Sanchez & Tardio 2016). The German Commission E recommendations also recommended this plant for treatment of several ailments like rheumatism, urinary tract disorders, kidney stones, prostrate complaints, irritable bladder to improve kidney health, increase urine flow, lowering high level serum creatinine, decrease joints pain, treatment of respiratory disorders, anti-allergic and flux out toxins from the body (Keller 1996). Clinical experiments also shown its pharmacological activities to control haemorrhage, vomiting of blood and bleeding from the nose and excessive menstrual flow (Ahamad & Parsuraman 2014). Several homeopathic

Table 1: Ethnobotanical uses of *U. dioica* in Kumaon and Garhwal regions and their cross verification

Districts	Participants		Total no. of participants	Ethnobotanical uses					
	M	F		V	S	T	AI/AR	AV	LP/SC
Almora	07	13	20	20	10	15	20	18	20
Bageshwar	05	15	20	20	15	16	20	20	20
Nainital	09	11	20	20	07	17	20	15	20
Chamoli	06	12	20	20	10	11	20	19	20

Abbreviations; M-male; F-female; V-vegetable; S-soup; T-tea; AI/AR- Anti-inflammatory/anti-arthritis; AV-anti-viral/air borne diseases; LP/SC- Local punishment during socio-cultural activities.

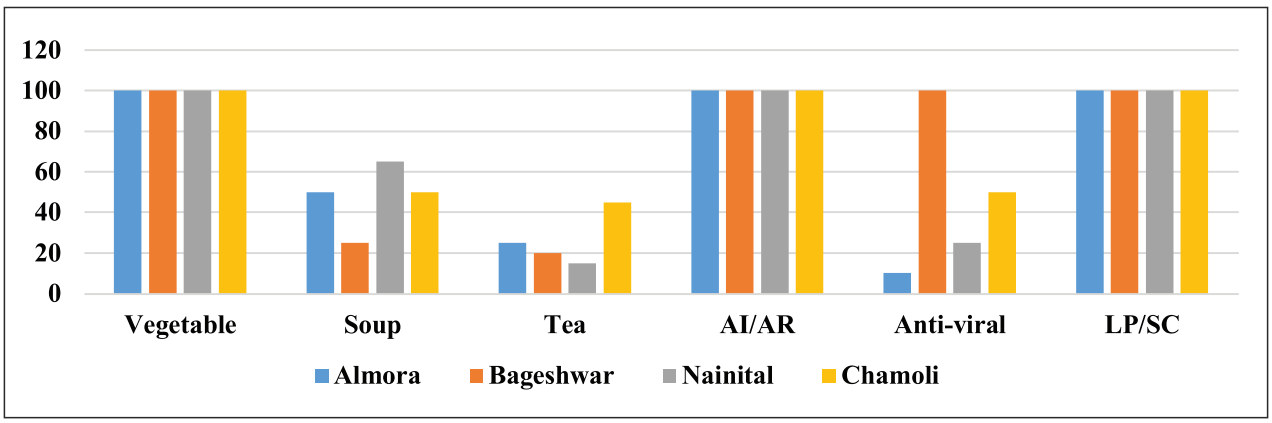

Fig. 6: Comparative analysis showed overall % agreements of the participants for traditional uses of *U. dioica* in different study areas

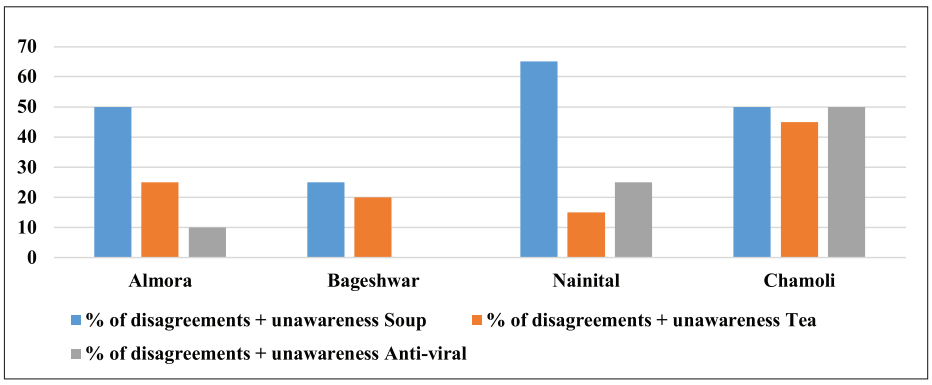

Fig. 7: Comparative analysis showed the % of participants disagree + % of participants unaware with traditional uses of *U. dioica* in different study areas

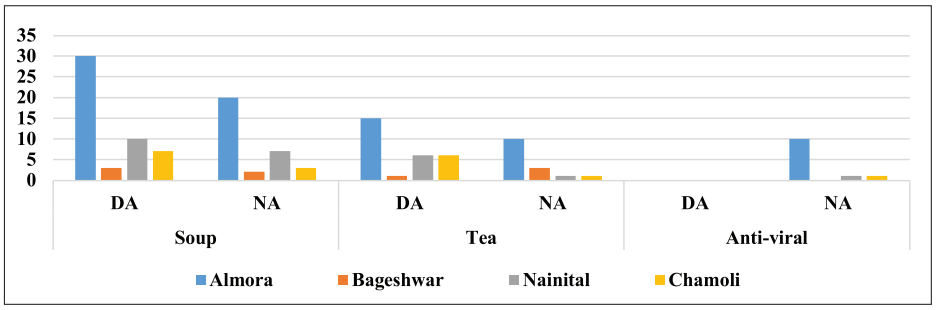

Fig. 8: Comparative analysis showing % disagreement of participants (DA)/ participants unawared (NA) with traditional uses of *U. dioica*

mother tinctures are made-up from this plant also used for the treatment of catarrh, leucorrhoea, brachial haemorrhage blood-splitting, uterine haemorrhage, nephritis, haematuria and menorrhagia, prevention of gout, erythema and vascular eruptions (Website 4 & 5) and various dietary supplements (Marchetti *et al.* 2018; Maietti *et al.* 2021). In ethno-veterinary practices of Italy, Switzerland, Spain and Australia, the plant is reported to use as animal nutrition and growth promoter (Disler *et al.* 2014).

Chemical constituents

The flavonoids kaempferol, isorhamnetin, quercetin, isoquercitrin, astragalin, rutin tannins, and their 3-rutinosides and 3 glycosides are mainly reported in this plant species (Ji *et al.* 2007; Ellnain-Wojtaszek *et al.* 1986; Bucar *et al.* 2006). However, the volatile compounds, carvacrol carvone, naphthalene, (E)-anethol, hexahydrofarnesyl acetone, (E)-geranyl acetone, (E)-β-ionone and phytol are the essential oil components present in this plant (Gul *et al.* 2012). The shikimic acid derivatives like phenylpropanes, caffeic acid and its various esters such as chlorogenic acid and caffeoylmalic acid (Bucaret *et al.* 2006; Grevsen *et al.* 2008) and carotenoid such as β-carotene, hydroxy-β-carotene, lutoxanthin, lutein epoxide and violaxanthin have also been reported (Ellnain-Wojtaszek *et al.* 1986; Kavtaradze & Alaniya 2003). The leaves are rich in vitamins B, C, K and minerals such as calcium, iron, magnesium, phosphorus, potassium and sodium (Joshi *et al.* 2014). Other constituents are essential amino acids, glucokinnins and a very high content of chlorophyll (Bombardelli & Morazzoni 1997). However, acetylcholine, histamine, 5-hydroxytryptamine (serotonin), leukotrienes and formic acid are mainly reported in leaves trichome (Fu *et al.* 2006).

Value added nutraceutical products and trades

Number of its value added products such as tea, nutritional or dietary supplements and other health beneficiary products are already trading by different pharma companies. The details of important value added marketed products of *U. dioica* and their prices collected from the literature (Website 1 & 2) are presented in Table 2. However, the tender leaves decoction (10-20 gm) of this plant was also approved by Food Safety and Standards Authority of India (FSSAI), statutory authority under Ministry of Health & Family Welfare, Govt. of India, *[Gazette of India, Extraordinary, Part -III, Section 4 notification, December 23rd, 2016]* and mentioned in the approved list or botanical ingredients S. No. 382 (Anonymous 2016).

Results and Discussion

The details of folk traditional uses of Stinging nettle collected from Almora, Bageshwar, Nainital and Chamoli districts of Uttarakhand Himalayas are discussed in Table 1. Whereas, the comparative analysis of agreements and overall disagreements (disagree + un-awareness) among the participants of study areas were discussed in Figures 6, 7 and 8. Traditionally, the plant is most popular as vegetable, anti-inflammatory/anti-arthritis (AI/AR) and in ancient socio-cultural activities for punishment (LP/SC) as well as to create a fear among the children with 100% acceptability in all the study areas (Figure 6). While marginal differences were observed on its traditional uses as anti-viral/air borne diseases with 5% (Chamoli), 10 % (Almora), and 25% (Nainital) as compared to 100 % agreements in Bageshwar district. Although, a significant percent of disagreements was observed on its traditional uses on hot soup and tea with 50% and 25%, in Almora, 15%, and 20% in Bageshwar while 65% and 15% in Nainital, and 50% and 45% in Chamoli district respectively (Figure 7). A comprehensive analysis between the percent of disagreements (DA) and not-aware (NA) about traditional uses of hot soup, tea and air born diseas-

Table 2: Important value added marketed herbal products of *Urtica dioica* and prices

S. No.	Trade name	Traders	Pack size	Price (INR)
1.	Sorich Organic Nettle leaves	Sorich Organic Pvt. Ltd	100 g	0589.00
2.	Zenith Nutrition Nettle Root Extract Supplement)	Medizen Labs Pvt. Ltd. (Nutritional	300mg x 90 capsules	1022.00
3.	The Indian Chai-Organic Nettle	Indian Chai (amozon.in)	100g	0575.00
4.	Jhungarbatti Stinging Nettle	Jhungarbatti (amazon.in)	200g	0369.00
5.	Stinging Nettle	Piping Rock.com	500mg x 100 capsules	0463.14
6.	Organic Nettle Leaf Urtica (Nature Tea)	Kiron Marketing Pune (support@kironservice)	1 Kg	4200.00
7.	Dietofy-Dietofy Nutrition Nettle (Health boosting)	www.dietofy.com care@dietofy.com	100g	1199.00
8.	Nettle Leaf Tea-Kayos	Himalayas	100g	0799.00
9.	Herbal Seed & Spices (Herbal Organic Nettle Leaf)	Herbal Seed & Spices Store, Uttarakhand	400g	0649.00
10.	Grenera Nettle Leaf (Herbal dilatory supplement)	Grenera Organics storefronts	100g	0480.00
11.	Nettle Leaf Tea (Source of Nutrition) Pvt. Ltd.	Beast Source@Nutrition	100g	0912.00
12.	Stinging Nettle Blend Herb Pharm (iBhejo.com,Support) Extract (healthy respiratory support@ bhejo.com)	4 Ounce	7957.00	
13.	Pollen Defence Compound Herb Parm, (Ninth Avenue.com (Dietary supplements)	4 oz liquid	6610.00	

Source: Website 1 & 2

es/anti-viral activities were presented in Figure 8. The major percent of participants (DA/NA) for traditional uses of hot soup and tea were observed by (30+20%) and (15+10%), respectively in Almora, while 10% participants showed their unawareness in each *i.e.* in Almora and Chamoli districts, respectively (Figure 8). These differences might be due to social, cultural and economic compatibility between urbanized, semi-urbanised (Nainital and Almora) and ethnic populations of Bageshwar and Chamoli districts. However, the above agreements of the participants for its traditional uses as antiviral herb has a great similarity with its traditional uses in central Italy for treating numerous viral diseases like *Herpes zoster* and *Herpes labialis* (Magaly *et al.* 2021; Uncini *et al.* 2005). In addition to that, the herbal preparation of *U. dioica* along with some other plant species showed anti-viral activity against the feline immunodeficiency virus (FIV) having biological and pathogenic features resembling with the human immunodeficiency virus (HIV) and showed its potential to reduce the mortality of SARS-CoV in infected mouse model (Kumaki *et al.* 2011). Furthermore, the plant extracts of stinging nettle reported as a rich source of iron, vitamins, minerals, flavonoids, proteins, tannins and several other beneficial steroidal or non-steroidal immune-modulatory compounds (Devkota *et al.* 2022). These evidences support the traditional patrimony of *U. dioica* as a strong anti-viral herb to prevent several kinds of viral infections. History reveals that when there was no any allopathic solution to control diseases, traditional therapies have been used as an old weapon to cure or control the pandemics like SARS in 2003 (Hyder *et al.* 2022). Similar situation was aroused during COVID-19 pandemic caused by a novel pathogen (corona virus) characterized by severe pneumonia and most common symptoms were fever, dyspnea, dry cough, fatigue, headache, anosmia, and ageusia (Gonzalez 2021; Yang *et al.* 2019; Gavriatopoulou *et al.* 2020), neurological complications include headache, myalgia, dizziness, encephalitis, stroke, epileptic seizures and Guillain-Barre syndrome (Kumar *et al.* 2021). Focusing to these symptoms, again the people were forced to approach towards their traditional medicines along with the combination of modern medicines and vaccinations parallel to boosting the immunity of the patients (Kumar *et al.* 2021; Dong & Gardener 2020). Traditionally

rich countries like India, China, Peru, Bolivia, Morocco, Nepal, Brazil, Italy etc. focused on those traditional medicinal plants, natural products or their preparations, pertained with antiviral and anti-inflammatory properties and to strengthen the immune system or treat respiratory diseases (Magaly *et al*. 2021; Grigore *et al.* 2020). Among these, the traditional Chinese medicine, like *Lianhua qingwen*, *Qingfei touxie fuzheng recipe*, *Shufeng jiedu* (Hayder *et al.* 2022) showed appreciable results in improving clinical symptoms, reduce mortality, and recurrence rates of the virus (Rojas *et al.* 2020). However, the Ayurvedic *Kadha* of Ghduchi ghan vati (*Tinospora cordifolia*) either alone or with the combination of Pipali (*Piper longum)* used in Indian traditional system of medicines, (Ayurveda, Yoga, Unani and Siddha) also confirmed its activity against SARS-CoV-2 (Matias *et al.* 2020; Lim *et al*. 2021). Such kinds of traditional medicinal plants and their bioactive fractions showed a beneficial role in prevention of COVID-19 and played a supportive role in interfering with the pathogenesis by inhibiting SARS-CoV-2 replication and entry to its host cells (Kumaki *et al.* 2021). Some other herbal products such as *Gymnanthemum amygdalinum, Azadirachta indica, Nigella sativa, Eurycoma longifolia, Glycyrrhiza glabra*, *Thymus vulgaris, Allium sativum, Althea officinalis,* and Ginseng also found to be effective in the preventive and management of COVID-19 (Hayder *et al.* 2022; Tanya *et al.* 2023).

Urtica dioica possess a supper antigen i.e. *Urtica dioica* agglutinin (UDA), which is an unusual plant lectin that differ from other known plant lectins with respect to its molecular structure and its low specific agglutination activity (Galelli & Truffa-Bachi 1993). This lectin contains a small stable plant monomer peptide (molecular weight 8.7 kDa and 86 amino acids) with the property of binding to N-acetyl glucose amine (Peumans *et al.* 1984). Earlier *in-vitro* studies on SARS-CoV using lethal model of BALB / c mouse, revealed that the UDA is able to inhibit SARS-CoV infection by inhibiting the binding function to the host cell (Kumaki *et al.* 2011). During infection of SARS-CoV-2, the spikes of SARS-CoV-2 enter into the host cell by attaching its receptor-binding domain (RBD) to angiotensin-converting enzyme-2 (ACE-2). The interaction between UDA and RBD of S-protein of SARS-CoV-2 showed that the binding of UDA to the RBD of S-protein, inhibits the RBD of S-protein and ACE-2 interaction and prevent the virus from entering the host cell (Lokhande *et al.* 2020). The results suggested that the UDA can be a potential candidate drug against SARS-CoV-2 (Lokhande *et al.* 2020; Fatemeh *et al.* 2024). Furthermore, Upreti *et al*. (2021) have applied bioinformatics tools for screening a series of bioactive compounds from *Urtica dioica* plant (collected from Uttarakhand Himalaya) as a potent inhibitors of SARS-CoV-2. On the basis of these investigations, World Health Organization suggested that *Urtica dioica* agglutinin (UDA) may be an antiviral agent against SARS-CoV-2 (Horby *et al.* 2020).

Conclusion

The ethno-botanical information reported in this paper reveals that *Urtica dioica* is a well-known wild vegetable plant in all the study areas of Uttarakhand and commonly used as anti-arthritis, anti-viral, anti-inflammatory in case of external injuries. The dried tender leaves are mostly used as soup and tea during extreme winters to warm-up the body and boosting immunity/ immune-modulatory agent against any kinds of viral infections. While its applications in ancient socio-cultural history for punishment to accused and creating fear among children was notable and quite interesting.

The marketed herbal products of stinging nettle (Table 2), chemical constituents and biological activities proved that this plant is medicinally rich which explain its applications during human history as a food, source of pigments, pharmaceutical, and cosmetic industries. Various extracts of *U. dioica* exhibited the significant biological activities, such as antioxidant, antiviral, antimicrobial, cytotoxic, and a rich source of minerals, iron, vitamins and others. While, the binding properties of UDA (a supper antigen and unusual plant lectins) to the RBD of S-protein and inhibition of RBD of S-protein and ACE-2 interaction and prevention of SARS-CoV-2 into host cell attest the patrimony of traditional uses and strongly supports to possess anti-viral, anti-HIV properties. Despite, having several biological activities nutraceutical, immune boosting, antiviral properties etc., this herb could be used during viral infection like COVID-19 pandemic. Furthermore, listing to this plant in Food Safety and Standards Authority of India's plant list (FSSAI), Ministry of Health and Family Welfare, [*Gazette of India, Notification, Extraordinary, Part -III, Section 4, December 23rd, 2016*] and their recommendations for its use in the health beneficiary herbal products also strongly verify its folk traditional claims reported in this paper. However, progress in our knowledge about this plant, its chemical composition, and biological benefits, the full potential of this plant remain unknown. Further studies are necessary to expand that knowledge and better utility of this plant with authentic scientific data and published guidelines on quality, safety, efficacy and regulatory aspects.

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Ethnomedicine for paralysis used by the tribes of Srikakulam district, Andhra Pradesh

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Abstract

The paper deals with 33 species of plants covering 29 genera and 17 families used for curing paralysis by the tribes of Srikakulam district, Andhra Pradesh. Fabaceae is the dominant family with seven species. Trees are represented by 11 species. *Globba racemosa* and 12 practices were found to be new.

Key Words: Facial paralysis, S*ilajittu*, Bioactive composition, Neural disorders

Introduction

Paralysis is a disease related to nervous disorder caused by damage of nerves and spinal cord that control muscles. The most common causes of paralysis are stroke, head injury, spinal cord injury, broken neck and multiple sclerosis. Paralysis can be of localized form, where a specific section of the body is paralyzed, such as the facial paralysis (Bell's Palsy) and paralysis of hand, or generalized form where a larger area of the body is affected. Paralysis when left untreated for a long period could lead to the 'death' of the affected part. Paralysis can also cause a number of associated secondary conditions, such as urinary incontinence and bowel incontinence. It may also affect sexual function in both men and women. In cases of permanent paralysis, treatment aims mostly at assisting a person live as independently as possible by addressing any associated complications that arise from paralysis (Mikawlrawng *et al.* 2018).

Study Area

Srikakulam district is the northern most part of Andhra Pradesh state, located within 18°5' - 19°12'N and 83°32' - 84°47'E and bounded by Odisha state on the North and Bay of Bengal in the East and South East and the Vizianagaram district in the West and South West (Fig.1). It is inhabited by 166,118 tribal people comprising of 6.15 per cent of the total population (Census 2011). The tribal communities include Savara, Jatapu, Konda dora, Gadaba, Kuttiya, Yerukula. Though there are publications on paralysis from different parts of India by different tribes (Rajasekhar *et al.* 1997; Suneetha *et al.* 2011; Mikawlrawng *et al.* 2018; Baghi & Nikakhtar 2020) the exclusive studies by the tribes of Srikakulam district were not taken up necessitating the present study.

Materials and Methods

The ethnomedicinal data presented here is the outcome of a series of intensive field studies conducted over a period of five years (1997-2001) in 74 interior tribal pockets. The field trips were planned in such a fashion so as to cover the selected tribal pockets in different seasons of a year. Each field trip was of 5-7 days duration covering 5-6 pockets in a day. In addition to the randomly selected informants in the field, tribal villages and shandies, 41 vaidhyas/medicine men have contributed their ethnomedicinal knowledge to the present study. Each medicinal practice was cross checked with at least 4-5 informants. Prior oral consent was obtained from the informants before initiating the study. Voucher specimens of ethnomedicinal plants were collected, herbarium specimens were prepared (Jain & Rao 1976) and identified using the Flora of the Presidency of Madras (Gamble 1915-1935) and deposited in the Herbarium of Department of Botany, Andhra University, Visakhapatnam (AUV). Publications of ethnomedicinal survey of the district includes a variety of diseases *viz*., asthma, boils, blisters and burns, cuts and wounds, diabetes, eye, hair diseases, and ulcers (Naidu *et al.* 2018; 2020 a,b,c; 2021; Swamy & Reddi 2022a,b).

Fig. 1: Map of study area (Srikakulam district)

Enumeration

The plants are enumerated alphabetically with valid botanical name followed by family and local name, English name, locality, collector and voucher specimen number. Each ethnomedicinal practice is provided with the part(s) used, method of preparation of the drug and mode of administration and dosage and the informant tribe in parenthesis. Plants involved in combination treatments are provided with voucher specimen number along with local name. Plants and practices marked with an asterisk (*) are considered to be new or less known after comparing with the data given by Jain (1991); Kirtikar & Basu (2003) and Jain & Jain (2016).

Abrus precatorius L. Fabaceae 'Gurivinda', Crab's eye. Jagati, NSS 1465
Root paste mixed with water is administered in 10 ml dose once a day till cure (Jatapu).

Acalypha indica L. Euphorbiaceae 'Kuppinta', Indian acalypha. Kotapalem, NSS 1016
Stem of *A. indica* with stem of *Ailanthus excelsa* Roxb. (Simaroubaceae) (Peddamanu) (1199), *Strychnos potatorum*, root bark of *Guilandina bonduc* L. (Fabaceae) (Gachha) (1240), tuberous roots of *Asparagus racemosus* Willd. (Liliaceae) (Pillithegalu) (1533) and *Commicarpus chinensis* Heimerl syn. *Boerhavia chinensis* (L.) Rottb. (Nyctaginaceae) (Atakamamidi) (1028), roots of *Rauvolfia serpentina* (L.) Benth. ex Kurz (Apocynaceae) (Sarpagandhi) (1749) and *Tinospora cordifolia* are taken in equal quantities and ground. Paste kept for *silajittu* (the above paste is kept in an earthen pot and its mouth is tightly closed with polythene cover and placed in the soil for 24 hrs. After mild heating for an hour, the solution should be filtered. Ten ml of *silajittu* mixed in a glass of goat milk is administered twice daily for 15 days (Konda dora).

Albizia saman (Jacq.) Merr. Fabaceae 'Nidra ganneru', Rain tree. Baligam, NSS 1743.
*Four spoonful of stem bark decoction is administered orally twice a day for 21 days. Stem bark paste mixed with egg albumen is also applied on the affected areas twice daily for 21 days (Jatapu).

Allium sativum L. Amaryllidaceae 'Tellulli', Garlic. Baruva, NSS 1268
One crushed bulb of garlic is boiled with 800 ml of milk and reduced to 200 ml is given to patients suffering from facial paralysis, once in a day for about a week (Yerukula).

Alstonia scholaris (L.) R. Br. Apocynaceae 'Edakulapala', Devil tree. Kandivalasa, NSS 1256
*Stem bark with stems of *Rotheca serrata* (L.) Steane & Mabb. (Lamiaceae) (Bommalamarri) (2145) and *Rauvolfia serpentina* taken in equal quantities are made into powder. A spoonful of powder along with water is administered twice a day for 21 days (Savara).

Anodendron paniculatum (Roxb.) A. DC. Apocynaceae 'Chedukura', King of bitters. Metturu, NSS 1351
*Five gram of tuber paste along with root paste (5g) of *Aristolochia indica* L. (Aristolochiaceae) (Gadidagadapa) (1153) is administered thrice a day for three days (Jatapu).

Atalantia monophylla (Roxb.) Corr. Rutaceae 'Adavi nimma', Wild lime. Makarajola, NSS 1682
Oil from fruit is used for external massage (Gadaba).

Capparis sepiaria L. Capparaceae 'Nalla uppi', Caper. Mandasa, NSS 1256 (Plate 1, Fig. a)
*Two spoonful of root decoction is administered once a day for seven days (Savara).

Capparis zeylanica L. Capparaceae 'Uppi', Ceylon caper. Baligam, NSS 1253
Root bark ground with that of aerial roots of *Ficus benghalensis* L. (Moraceae) (Marri) (1716) and tail of garden lizard and the paste is made into pills of five gram is administered once a day for 40 days (Gadaba).
Five gram of stem bark powder mixed with a pinch of camphor and 100 ml of water is taken orally once a day for 15-30 days (Gadaba).

Dalbergia lanceolaria L. f. Fabaceae 'Pachari', Takoli. Kowsalyametta, NSS 1346
Stem bark with stem bark of *Ziziphus xylopyrus,* roots of

Strychnos nux-vomica, Rauvolfia serpentina and leaves of *Andrographis paniculata* (Acanthaceae) (Burm. f.) Wall. ex Nees (Nelemu) (1349) are taken in equal quantities and ground. Two spoonful of powder mixed in 200 ml of cow milk is administered daily once before breakfast for about 40 days (Savara).

Dichrostachys cinerea (L.) Wight & Arn. Fabaceae 'Yelturu chettu', Sicklebush. Jalantrakota, NSS 1438 (Plate 1, Fig. b)
Roots are crushed to make extract. This extract is mixed with garlic juice in proportions of 10:1, with a pinch of black pepper powder and 50 ml of this extract is given to the patient once in a week for about six weeks (Jatapu).

Dodonaea viscosa (L.) Jacq. Sapindaceae 'Bandari', Jamaica switch sorrel. Baligam, NSS 1184
*Leaves with leaves of *Tinospora cordifolia* taken in equal quantities are ground. Two spoonful of paste is administered daily twice for nine days. Meanwhile one kg of leaves are boiled in a bucket of water and used for taking bath once daily till cure (Konda dora).

Ficus racemosa L. Moraceae 'Medi', Cluster fig. Makarajola, NSS 1220
Leaf juice together with boiled rice washed water and jaggery is given twice a day for a month followed by the application of sheep butter externally on the paralyzed portion (Kuttiya).

Ficus religiosa L. Moraceae 'Rayi', Peepul tree. Metturu, NSS 1025
Fifty ml of root bark decoction mixed with buttermilk is administered in two-three spoonfuls twice a day for about 30 days (Gadaba).

****Globba racemosa*** Smith Zingiberaceae 'Osso', Yellow swan flower. Kowsalyametta, NSS 1250 (Plate 1, Fig. c)
Tuber paste along with jaggery mixed with castor oil and bear oil is tied on the affected parts (Kuttiya).

Jatropha curcas L. Euphorbiaceae 'Nepalam', Physic nut. Lakkivalasa, NSS 1894
Root bark with tuberous roots of *Mirabilis jalapa* L. (Nyctaginaceae) (Chandrakantha) (1774) and rhizome of *Curcuma longa* L. (Zingiberaceae) (Pasupu) (1232) taken in equal quantities are ground. Paste is applied on the affected areas twice a day for 21 days (Savara).

Litsea glutinosa (Lour.) C. B. Robinson Lauraceae 'Naramamidi', Common fallow laurel. Bejji, NSS 1531
*Stem bark with stem barks of *Dalbergia latifolia* Roxb. (Fabaceae) (Iridi) (1346) and *Haldina cordifolia* (Roxb.) Ridsdale (Rubiaceae) (Kamba) (1825) taken in equal quantities are powdered. Two spoonful of this powder mixed in a glass of cow milk is administered early in the morning for 15 days (Jatapu).

Maerua oblongifolia (Forsk.) A. Rich. Capparaceae 'Bhuchakram', Desert caper. Ashokam, NSS 1121 (Plate 1, Fig. d)
*Root bark with stem barks of *Gmelina asiatica* L. (Lamiaceae) (Gummadi) (1309), *Withania somnifera* (L.) Dunal (Solanaceae) (Aswagandha) (1172) and tubers of *Boerhavia chinensis* taken in equal quantities are ground and the paste is made into pills of five gram. Two pills are administered along with honey twice daily for 10 days and another 20 days with 'neem' juice (*Azadirachta indica* A. Juss., Meliaceae) (Vepa) (1837). Meanwhile, the above paste is massaged on the paralysed parts twice daily for 21 days (Konda dora).

Manihot esculenta Crantz. Euphorbiaceae 'Karra pendalam', Mountain sweet potato. Raiwada, NSS 1590
*****Tuber is roasted and administered once daily till cure (Kuttiya).

Pavonia zeylanica (L.) Cav. Malvaceae 'Karu benda', Doctorbush. KR Peta, NSS 2300
*****Twenty ml of root decoction is administered with sugar candy twice a day for about 20 days (Kuttiya).

Plumbago zeylanica L. Plumbaginaceae VN: 'Tella chitramulamu', Ceylon lead-wort. Lakkivalasa, NSS 1504
Roots with roots of *Tamarindus indica* L. (Fabaceae) (Chinta) (2164) and *Calotropis gigantea* (L.) W.T. Aiton (Asclepiadaceae) (Tella jilledu) (1852) taken in equal quantities are ground. Two spoonful of paste is administered orally twice daily for 21 days (Yerukula).

Pongamia pinnata (L.) Pierre Fabaceae 'Ganuga', Indian beech tree. Peddakedari, NSS 2157
Roots with roots of *Boerhavia chinensis*, tuberous roots of *Mirabilis jalapa* and *Asparagus racemosus* taken in equal quantities are ground. A spoonful of paste with egg albumen mixed in a glass of cow milk is administered twice daily for 15 days. Meanwhile the paste is applied on the affected areas once daily for 15 days (Yerukula).

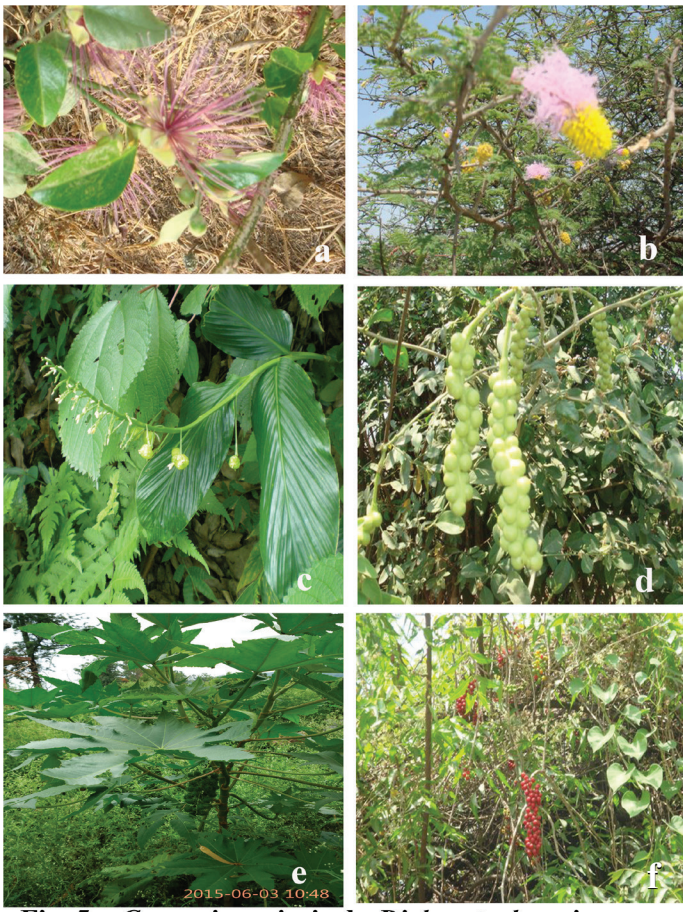

Fig. 5a. *Capparis sepiaria*, b. *Dichrostachys cinerea*, c. *Globba racemosa*, d. *Maerua oblongifolia* e. *Ricinus communis*, f. *Tinospora cordifolia*

Ricinus communis L. Euphorbiaceae 'Amudamu', Castor oil. Jalantrakota, NSS 1467(Plate 1, Fig. e)
Two spoonful of leaf paste is administered orally twice daily for 21 days. Seed oil is also massaged on the affected areas once daily for 21 days (Yerukula).

Senna occidentalis (L.) Link Fabaceae 'Kasinda', Coffee senna. Jalantrakota, NSS 1562
Dried root powder mixed with root powder of *Tephrosia purpurea* ground with jaggery is taken in one spoonful once in a day for about 45 days (Jatapu).

Sida acuta Burm. f. Malvaceae 'Parasu Kampa', Common Wireweed. Sitampeta, NSS 1522
Root poultice mixed with sesame oil (*Sesamum indicum* L. Pedaliaceae) (Nuvvulu) (2233) is gently massaged on the affected parts (Kuttiya).

Sida cordata (Burm. f.) Borss.Waalk. Malvaceae 'Gayapaku', Ilima. Makarajola, NSS 1960
Leaf juice is mixed with goat milk and two spoonfuls is administered twice a day till cure (Gadaba).

Smilax zeylanica L. Smilacaceae 'Phirangi Mokka', Rough bind weed. Yetapaka, NSS 2178
Tuberous roots are ground with *Piper longum* L. (Piperaceae) (Pippali) (1096) and the extract is administered in two spoonful twice a day for about one month (Savara).
Thirty ml of leaf decoction is administered orally twice a day till cure (Kuttiya).

Solanum virginianum L. Solanaceae 'Aakudu', Wild Eggplant. Metturu, NSS 1918
Fruit juice mixed with sesame oil (*Sesamum indicum*) is applied on affected parts daily for about 60 days.
Leaf poultice is applied on the affected parts and gently massaged till cure (Yerukula).

Strychnos nux-vomica L. Loganiaceae 'Mushini', Snake wood. Kadangandi, NSS 1939
Ten gram of seed powder mixed with half teaspoon of honey is administered once a day till cure (Gadaba).

Strychnos potatorum L.f. Loganiaceae 'Induga', Clearing nut tree. Karakavalasa, NSS 1016
*Handful of seeds are kept in cow dung for one hour and boiled. Seeds are cleaned with urine of cow and ground. Two spoonful of seed paste mixed with a spoonful of leaf paste of *Andrographis paniculata* and egg albumen is administered once a day for 15 days. Meanwhile the paste is applied on the affected areas once a day for 15 days (Savara).

Tephrosia purpurea (L.) Pers. Fabaceae 'Yempali', Wild indigo. Antikonda, NSS 2275
*Dried root powder mixed with root powder of *Senna occidentalis* ground with jaggery is taken in one spoonful once a day for about 45 days (Yerukula).

Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thoms. Menispermaceae 'Amruthavalli', Gulancha tinospora. Burna konda, NSS 2330 (Plate-1, Fig.- f)
Stem with tuberous roots of *Boerhavia chinensis* and *Asparagus gonoclados* Baker (Liliaceae) (Sathavari) (1534) taken in equal quantities are ground. Paste is made into pills of five gram. Two pills along with honey is administered twice daily for 21 days (Kuttiya).

Ziziphus xylopyrus (Retz.) Willd. Rhamnaceae 'Gotti kaya', Golden silk cotton. Chinnagora, NSS 1136
*Thirty ml of leaf juice is administered twice a day till cure (Kuttiya).

Results and Discussion

The paper deals with 33 species of pants covering 29 genera and 17 families used by the tribes of Srikakulam district, Andhra Pradesh, for curing paralysis. Family-wise, habit-wise and morphological analysis data is presented in Figs. 2-4. The crude drugs are administered either in the form of powder, paste, juice, decoction, poultice, or extract, along with either water, milk, cow milk, goat milk, honey, jaggery, sesame oil, egg albumen, sugar candy, neem juice, butter milk, castor oil, bear oil, sheep butter, or rice washed water. *Globba racemosa* and 12 practices were found to be new or less known (Jain 1991; Kirtikar & Basu 2003; Jain & Jain 2016). Plants used for similar purpose in different parts of India, Bangladesh and Ethiopia are *Abrus precatorious* by the Santhal, Paharia tribes of Dumka district, Bihar (Chandra *et al.* 1985), people in southern districts (Rajendran *et al.* 2008) and Thanjavur district (Jayakumar 2015) of Tamil Nadu; *Solanum virginianum* by the Savara, Jatapu, Gadaba tribes of Srikakulam district, Andhra Pradesh (Rao & Sreeramulu 1985); *Atalantia monophylla, Dichrostachys cinerea, Pongamia pinnata, Ricinus communis, Sida cordata, Solanum virginianum, Strychnos nux-vomica* and *Tinospora cordifolia* by the Sugali tribes of Andhra Pradesh (Rajasekhar *et al.* 1997); *Dichrostachys cinerea, Ricinus communis, Tinospora cordifolia* by the Yanadi, Nakkala, Irula, Yerukala, Sugali tribes of Chittoor district, Andhra Pradesh (Vedavathy *et al.* 1997), *Dichrostachys cinerea* by the folklore of Rangareddy district, Andhra Pradesh (Reddy & Rao 2002); *Pongamia pinnata* by the Chenchu, Yerukula, Sugali, Yanadi tribes of Chittoor district, Andhra Pradesh (Pratap *et al.* 2009), Bhunja, Kandha, Gand, Banjara, Sabar, Bhottada Dal tribes of Kalahandi district, Odisha (Mallik *et al.* 2012); *Dalbergia lanceolaria, Pongamia pinnata* by the Konda Reddi, Konda Kapu, Konda Kammara, Konda Dora, Koya Dora, Manne Dora and Valmiki tribes of East Godavari district, Andhra Pradesh (Suneetha *et al.* 2011); *Ficus religiosa,* and *Sida cordata* by the Chenchu tribe of Nallamalais, Andhra Pradesh (Rao & Sunitha 2011), *Senna occidentalis* by the *Baiga* tribe of Achanakmar-Amarkantak Biosphere Reserve, Central India (Tiwari *et al.* 2012); *Allium sativum* by the people in Kilte Awulaelo district of Ethiopia (Teklay *et al.* 2013); *Strychnos nux-vomica* by the people in India (Singh *et al.* 2015); *Ricinus communis* by the people of Narsingdi district of Bangladesh (Rahman & Debnath 2015); *Jatropha curcas* by the Hindu Malayali tribes of Namakkal district, Tamil Nadu (Raju *et al.* 2015); *Abrus precatorius, Allium sativum, Ficus religiosa, Jatropha curcas, Pongamia pinnata, Sida cordata* by the people of India (Mikawlrawng *et al.* 2018) and *Abrus precatorius, Allium sativum, Pongamia pinnata* in India (Baghi & Nikakhtar 2020). *Albizia saman, Alstonia scholaris, Anodendron paniculatum, Capparis sepiaria, Dodonaea viscosa, Globba racemosa, Litsea glutinosa, Maerua oblongifolia, Manihot esculenta, Pavonia zeylanica, Strychnos potatorum, Tephrosia purpurea,* and *Ziziphus xylopyrus* are yet to be scientifically validated against paralysis.

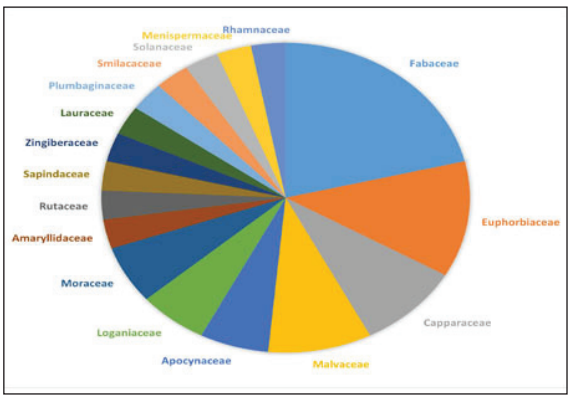

Fig. 2: Family analysis of anti-paralytic plants

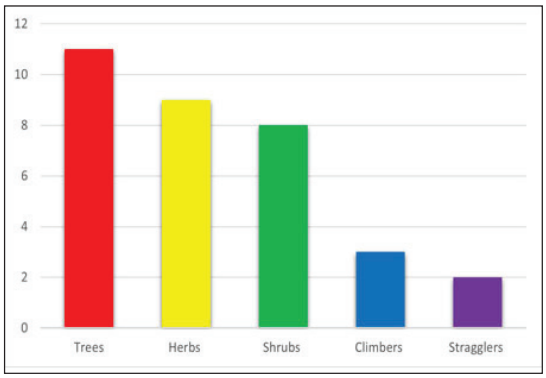

Fig. 3: Habit-wise analysis of anti-paralytic plants.

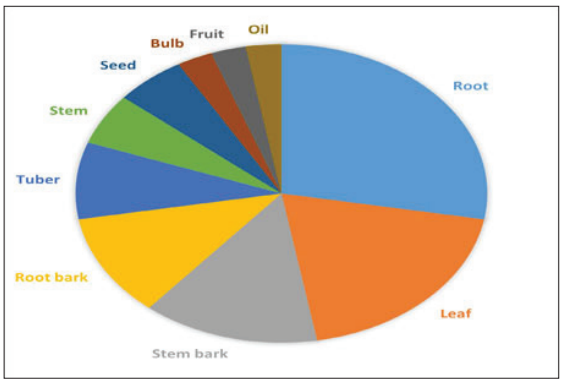

Fig. 4: Morphological analysis of anti-paralytic plants.

The search for cure of paralysis is yet to be found. Many ethnobotanical surveys have reported the use of medicinal plants by various ethnic communities for treatment and cure of paralysis. The present paper discusses the use of medicinal plants in Srikakulam district, Andhra Pradesh, for ameliorating and curing paralytic conditions, as well as discusses some of the important developments in future possible applications of medicinal plants in treatment of paralysis. No doubt the present information are undeniably

useful, as ethnobotanical survey data and traditional knowledge of medicinal plants are one of the irreplaceable pools of knowledge, in which unplumbed information are stored. It is believed that with deeper research into the bioactive composition and mode of action of the chemical contents of these documented medicinal plants, a goal for finding important lead compounds for treatment of ailments and complications associated with neural disorders leading to paralysis, can indeed be achieved in future.

Conflict of Interest: The authors have no conflict of interest.

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Traditional anti-rheumatic plants used by Locals in Bhaderwah, District Doda, Jammu & Kashmir

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Abstract

Rheumatism, a chronic and painful autoimmune condition, significantly impairs mobility and quality of life. Modern pharmacological treatments, though effective, often carry adverse effects, particularly with long-term use. This has led to renewed interest in traditional plant-based remedies, particularly in remote regions where access to allopathic medicine is limited. The present ethnobotanical study was conducted in Bhaderwah, District Doda, Jammu and Kashmir, to document indigenous knowledge related to the treatment of rheumatic ailments. Data was gathered through interviews with 40 local informants, including traditional healers, across various age groups. A total of 15 plant species from 13 families were identified for their traditional use against rheumatism. Roots and rhizomes were the most commonly used plant parts; prepared into oils, pastes, decoctions, and tinctures for topical and oral administration. The Cultural Importance (CI) Index highlighted *Aesculus indica*, *Olea ferruginea* and *Dolomiaea costus* are the most culturally significant species. The study underscores a generational shift in healthcare preferences, with older individuals favouring traditional knowledge systems. These findings not only contribute to the preservation of bio-cultural heritage but also offer valuable leads for future pharmacological investigations into plant-based anti-rheumatic therapies.

Key Words: Traditional knowledge, Rheumatoid arthritis, Ethnobotany, Anti-inflammatory plants, *Aesculus indica*

Introduction

Rheumatism, often used interchangeably with rheumatoid arthritis (RA), is a chronic, systemic autoimmune disorder that predominantly targets the synovial joints, the flexible joints in the knees, hands and other mobile parts of the body. This disease is characterized by persistent inflammation of the joint lining, which can cause swelling, intense pain, stiffness and progressive erosion of cartilage and bone. Over time, if left untreated or poorly managed, RA can lead to irreversible joint damage, disability and a significantly diminished quality of life (Zhou *et al.* 2022). The underlying pathophysiology involves an aberrant immune response wherein the body's immune system mistakenly attacks its own tissues, particularly the synovium, triggering a cascade of inflammatory processes (Chauhan *et al.* 2023). To mitigate the symptoms and slow down disease progression, current medical approaches primarily rely on pharmacological interventions, most notably Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) and Disease-Modifying Antirheumatic Drugs (DMARDs). NSAIDs such as ibuprofen and diclofenac are widely prescribed for their efficacy in alleviating pain and inflammation. However, their chronic use is frequently accompanied by adverse effects including gastrointestinal irritation (e.g., ulcers, bleeding), renal dysfunction and elevated cardiovascular risk. These risks become particularly pronounced in elderly patients or those with pre-existing conditions (Roodenrijs *et al.* 2021). On the other hand, DMARDs including methotrexate, sulfasalazine and biologics like TNF inhibitors aim to slow the progression of joint destruction by modulating the immune response (Abbasi *et al.* 2019). While they offer a more targeted approach, DMARDs can also result in immunosuppression, increasing vulnerability to infections and other complications (Caporali *et al.* 2008). Given these challenges, there has been a growing emphasis on exploring alternative therapies that are not only effective but also have a more favourable safety profile.

Therefore, researchers and clinicians are increasingly turning towards integrative approaches including plant-based compounds, traditional medicinal systems and nutraceuticals which may provide anti-inflammatory and immunomodulatory effects with fewer side effects (Goyal & Chauhan 2024). This shift reflects a broader movement toward sustainable as well as patient-centred healthcare that prioritizes both efficacy and long-term well-being (Chauhan *et al.* 2023). In this context, plant-based traditional medicine offers a promising avenue for the discovery of novel therapeutic agents. Herbal remedies, which have been used for centuries in various traditional healing systems often exhibit anti-inflammatory, analgesic and immunomodulatory properties with fewer adverse effects. Ethnomedicinal knowledge, preserved through oral traditions and cultural practices provides a rich resource for identifying potential medicinal plants with activity against rheumatic disorders (Adams *et al.* 2009; Salihu *et al.* 2018; Banik *et al.* 2020).

The earlier ethnobotanical investigation (Dutt *et al.* 2015) documented approximately 190 plant species used by the Gaddi shepherds, a transhumant community migrating seasonally between low and high elevations. Their ethnomedicinal knowledge reflects the cumulative adaptation to varied ecological zones encountered during their movement. The current study, however, was conducted in Bhaderwah, a permanent settlement and culturally distinct township located along the traditional migratory route of the Gaddi shepherds. Unlike the previous study, which focused exclusively on the Gaddi community across their migratory landscape, the present research aims to explore the convergence and divergence of ethnomedicinal knowledge specifically related to rheumatism among two interacting yet culturally and socioeconomically different groups, the transient Gaddi shepherds and the settled local inhabitants of Bhaderwah. The current study also deals with the detailed procedures of preparation of remedies. Studying such ethnomedicinal practices can contribute significantly to the development of alternative treatments, especially in regions where access to conventional medicine is limited (Popovic *et al.* 2016).

Methodology

The study was carried out using a structured ethnobotanical approach involving fieldwork, community engagement, and documentation of information. The methodology followed is detailed below in a stepwise manner:

- *Selection of Study Area*: The ethnobotanical survey was conducted in the Bhaderwah region of Doda district, located in the Union Territory of Jammu and Kashmir, India (Figure 1). The area was selected due to its rich plant diversity, cultural heritage and the continued reliance of local communities on traditional medicine systems. People of the study area use about 90 plant species for medicine, food, tea, fire and tanning purposes (Haq & Singh 2020).

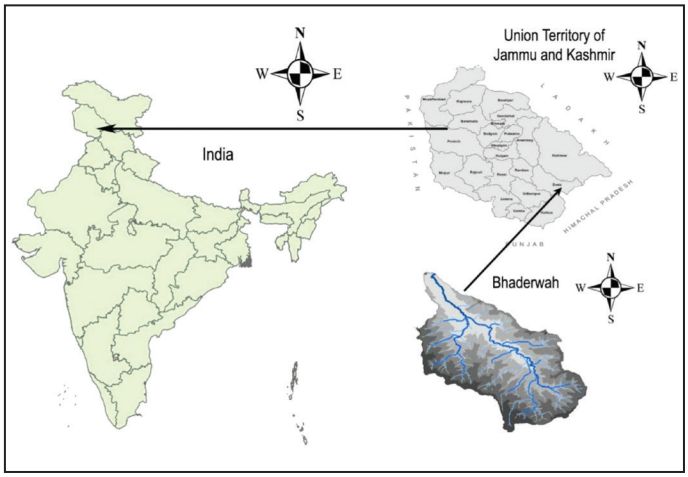

Fig. 1: Location map of Bhaderwah (Study Area)

- *Reconnaissance and Community Engagement*: Preliminary visits during May to July months of 2024 were made to establish rapport with the local inhabitants of the study area. Prior informed consent was obtained from participants before initiating data collection. Ethical guidelines for ethnobotanical research were strictly followed, ensuring respect for indigenous knowledge systems.

- *Data Collection through Interviews*: Semi-structured questionnaires were used to obtain data from the informants. A total of 40 local informants including traditional healers (*Vaidyas* and *Hakims*), old and young locals were interviewed (Table 1). The interviews focused exclusively on plants traditionally used for anti-inflammatory purposes particularly in the treatment of rheumatism.

- *Information Recorded*: During the interviews, the following data was collected for each reported plant species:
    - Vernacular/local name
    - Scientific name (later identified)
    - Part(s) of the plant used
    - Preparation method (*e.g.*, decoction, paste, infusion etc.)
    - Mode of administration/application

- *Identification and Authentication:* One of the members of the research team was familiar to the local language and dialect. Therefore, the documented specimens were identified in the field with the help of local traditional healers**.** The taxonomic identification was confirmed using the local floras (Sharma & Kachroo

1981; Vidyarthi 1997) and the correct botanical names were authenticated using an online database 'Plants of the World (POWO)'. The collected specimens have been deposited in Herbarium, Department of Botany, University of Jammu, Jammu (HBJU).

- *Cultural Importance Index:* Normally Cultural Importance (*CI*) Index is calculated using below given formula (Hoffman & Gallaher 2007):

$$Cl_s = \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} \frac{UR_{ui}}{N}$$

Since, the study is focused on one ailment only, therefore, formula for cultural importance index has been modified and *CI* is calculated using the formula:

$$CI_s = \sum UR / N$$

{where UR is the number of use reports for a species and N is the total number of informants}

- *Threat status*: The conservation status of the recorded plant species was evaluated using the IUCN red list of threatened species, the most widely accepted global framework for assessing extinction risk. Each species was individually searched on the online red list database of IUCN. The respective threat category was recorded based on the latest available global assessment.

Results and Discussion

- *Demography:* The demographic profile of the informants reveals a nearly balanced gender representation, with 21 males and 19 females participating in the study. Among these, two individuals identified as local traditional healers, one male and one female, indicating the inclusion of knowledgeable custodians of indigenous healthcare systems. The age-wise distribution shows that the majority of participants (20 individuals) belong to the 51–65 years' age group, followed by 11 informants in the 20–35 years' group and 9 in the 36–50 years' group (Table-1). This indicates a dominant contribution from older adults who are generally more experienced and are likely to possess a richer repository of traditional ecological or medicinal knowledge.

Health care preferences analyzed across age groups revealed a clear generational gradient. Informants in the 20–35 years' age group exhibited a marked preference for allopathic healthcare systems, ranking it first, followed by Ayurveda, with no reliance on oral traditional knowledge. The 36–50 years' group maintained a preference for both allopathy and Ayurveda, placing them jointly at the top, but also recognized oral traditional knowledge as a secondary healthcare option. Interestingly, the 51–65 years' age group showed a reversal in preference, with both Ayurveda and oral traditional knowledge occupying the first rank, while allopathy was placed 2nd (Table 1). This generational variation suggests that younger individuals are more inclined towards modern medical practices, whereas older informants still value and rely on traditional healthcare systems, especially those transmitted orally through community knowledge systems.

- *Ethnobotanical quantification:* A total of 15 plant species were documented for their use in the treatment of rheumatic pains by the local people, encompassing a range of families such as Asteraceae, Ranunculace-

Table 1: Demography of the informants

Informants			
Male	20		
Female	18		
Traditional healers	2 (1 male and 1 female)		
Children	Nil		
Age groups			
20-35 years	11		
36-50 years	9		
51-65 years	20		
Health care system (Preferences)	**Age groups**		
	20-35 years	36-50 years	51-65 years
Allopathy (Hospitals. Primary Health Centres)	1st	1st	2nd
Ayurveda (Hospitals. Primary Health Centres)	2nd	1st	1st
Oral traditional knowledge	Nil	2nd	1st

ae, and Sapindaceae. The majority of these species are herbs (10 species), followed by trees (4 species) and one shrub, suggesting a strong reliance on herbaceous flora for medicinal purposes. The plant parts most frequently utilized were roots and rhizomes, which are generally considered to contain potent therapeutic compounds in traditional medicine systems and are used by the local people for treating musculoskeletal disorders like inflammation, redness, tenderness and restricted mobility, joint stiffness, swelling and muscular discomfort related with gout and rheumatic pains (*Figure 2a*). Because of partial extraction of underground parts from mature plants and rotational/seasonal harvesting the less destructive approach is followed by the people in the area. According to traditional healers, *Betula utilis* is used as diuretic based on the perception that it facilitates the elimination of uric acid from the body (Table-2). It indicates that traditional healers are also getting exposed to the modern medical practices.

Since, the study revolves around the single ailment *i.e.* rheumatism, therefore, cultural importance index has been calculated wherein high value of *Aesculus indica* (0.625) indicate its high acceptability among the local inhabitants of the area. The Cultural Importance (CI) Index varied notably among the species, reflecting the relative significance of each plant in the local ethnomedicinal repertoire. *A. indica* (CI: 0.625), *Olea ferruginea* (CI: 0.6), and *Dolomiaea costus* (CI: 0.6) emerged as the most culturally significant species for treating rheumatic ailments. These species, being trees or large herbs, provide either seeds or roots, which are likely seen as effective based on traditional knowledge and perceived efficacy. *Jurinea macrocephala* (CI: 0.525) and *Prinsepia utilis* (CI: 0.55) also recorded high cultural importance, further underlining the prominence of root and seed-based remedies. In contrast, several species such as *Ranunculus arvensis* (CI: 0.05), *Taraxacum officinale* (CI: 0.075), and *Delphinium roylei* (CI: 0.15) held minimal cultural significance, possibly due to their limited efficacy, rarity, seasonal availability or declining use in current traditional practices (Table -2).

The documented species were grouped into three categories based on their Cultural Importance (CI) values: (a) species with high cultural importance (CI > 0.45), including *J. macrocephala*, *P. utilis*, *O. ferruginea*, *D. costus*, and *A. indica*; (b) species with moderate cultural importance (CI = 0.225–0.425), such as *Fagopyrum cymosum*, *Gentiana argentea*, *Rhododendron campanulatum*, *Iris kemaonensis*, and *Betula utilis*; and (c) species with low cultural importance (CI ≤ 0.20), represented by *R. arvensis*, *T. officinale*, *D. roylei*, *Trifolium repens*, and *Atropa acuminata (Figure 2b)*. Interestingly, despite being taxonomically diverse, the plants show convergent use in terms of plant part preference and therapeutic application, particularly targeting rheumatic pain through anti-inflammatory or analgesic properties.

Although both *A. indica* and *R. arvensis* are wildly distributed in the study area but some people have grown *A. indica* trees personally in their private lands. The seeds of this tree are roasted and then grounded to squeeze out oil which is applied on the joints suffering from rheumatic pains. One more reason of growing this tree species is the use of its seeds as the fodder to sheep and goats. *R. arvensis* being a seasonal herbaceous species has low popularity among the inhabitants of the area. Moreover, very few informants possess the traditional knowledge associated with *R. arvensis*.

About 190 plants are used by Gaddi Shepherd to treat various ailments, wherein *A. indica* with low UV (0.05) indicate its least use by the shepherd to treat rheumatic ailments (Dutt *et al.* 2015). As the Gaddi shepherds follow a transhumant

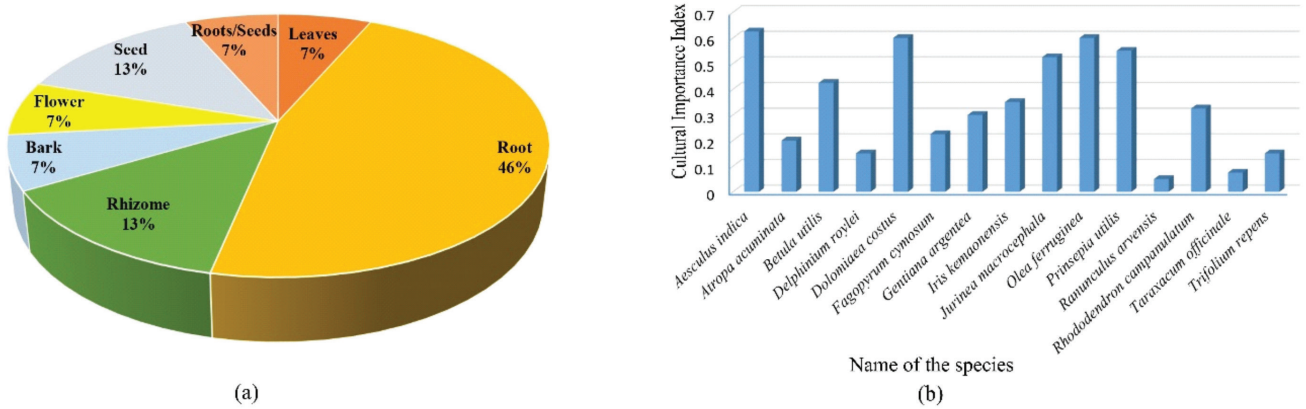

Figure 2: (a) Plant parts used by local people for treating rheumatic pains; (b) Cultural Importance Index of the species

Table 2: Plants used to treat rheumatic pains by the local people of Bhaderwah and their cultural importance

S. No.	Botanical name	IUCN status	Vernacular name	Habit	Parts used	Mode of preparation & administration	Cultural Importance (CI) Index
1.	*Aesculus indica* (Wall. ex Cambess.) Hook. Family: Sapindaceae Accession no.: 6198	Least Concern	Goon	Tree	Seeds	Oil used topically	0.625
2.	*Atropa acuminata* L. Family: Solanaceae Accession no.: 6132	Endangered	Belladona	Herb	Roots	Paste applied topically	0.2
3.	*Betula utilis* D. Don Family: Betulaceae Accession no.: 11664	Least Concern	Bhuj	Tree	Bark	Decoction	0.425
4.	*Delphinium roylei* Munz Family: Ranunculaceae Accession no.: 11516	Not mentioned	Laayt	Herb	Roots	Paste applied topically	0.15
5.	*Dolomiaea costus* (Falc.) Kasana & A.K. Pandey Family: Asteraceae Accession no.: 11975	Critically Endangered	Kuth	Herb	Roots	Powder	0.6
6.	*Fagopyrum cymosum* (Trevir.) Meisn. Family: Polygonaceae Accession no.: 16983	Not mentioned	Fayfroo	Herb	Roots	Decoction	0.225
7.	*Gentiana argentea* (D. Don) Griseb. Family: Gentianaceae Accession no.: 8654	Not mentioned	NA	Herb	Rhizome	Decoction or infusion (Oral and topical)	0.3
8.	*Iris kemaonensis* Wall. ex. D. Don Family: Iridaceae Accession no.: 7195	Not mentioned	Majar Mundi	Herb	Rhizome	Oral and topical	0.35
9.	*Jurinea macrocephala* DC. Family: Asteraceae Accession no.: Nil	Not mentioned	Google Dhooph	Herb	Roots	Oil	0.525
10.	*Olea ferruginea* Royle Family: Oleaceae Accession no.: 6042	Not mentioned	Jaitoon	Tree	Roots/ Seeds	Oil	0.6
11.	*Prinsepia utilis* Royle Family: Rosaceae Accession no.: 16995	Not mentioned	Jientoii	Shrub	Seeds	Oil	0.55
12.	*Ranunculus arvensis* L. Family: Ranunculaceae Accession no.: 14859	Not mentioned	Khabal	Herb	Roots	Paste	0.05
13.	*Rhododendron campanulatum* D. Don Family: Ericaceae Accession no.: 11817	Not mentioned	Chihun	Tree	Leaves	Poultices or infusion	0.325
14.	*Taraxacum officinale* F. H.Wigg. Family: Asteraceae Accession no.: 2417	Least Concern	Handri	Herb	Roots	Oil, Paste or infusion	0.075
15.	*Trifolium repens* L. Family: Fabaceae Accession no.: 1228	Least Concern	NA	Herb	Flowers	Tincture Oral or topical	0.15

lifestyle, their level of dependency is closely linked to the availability of natural resources. The ethnobotanical record not only reflects the richness of local traditional knowledge but also underscores the importance of certain plant species as culturally embedded remedies for rheumatic conditions (Dean 2024). The relatively high CI values of certain plants could guide future pharmacological or conservation efforts, especially in the context of safeguarding bio-cultural heritage and promoting community-based healthcare systems (Leonti 2022).

Local Remedies: Traditional knowledge held by local communities also revealed a variety of methods for preparing plant-based local remedies to treat rheumatic pain. During the study several drug preparation techniques were documented. Oils extracted from the seeds *A. indica, O. ferruginea* and *P. utilis* and roots of *J. macrocephala*, highlighted the significance of lipid-based applications in folk remedies (Husaini 2010). In contrast, drugs from the species such as *A. acuminata*, *R. arvensis* and *Delphinium roylei* are typically prepared as thick pastes from crushed roots. Decoctions or infusions made by boiling plant parts in water are other widely used methods documented during the study. Bark of *B. utilis*, roots of *Fagopyrum cymosum*, rhizomes of *Gentiana argentea* and *Iris kemaonensis* and leaves of *Rhododendron campanulatum* are transformed to decoctions or infusions, whereas powdered forms derived from dried and ground roots of *D. costus* and *T. officinale* offer a convenient and storable arrangement of the drugs. Additionally, *Trifolium repens* has been used in form of a tincture by soaking flowers in country made liquor to extract bioactive compounds. It means diversity in preparation and administration reflects the adaptability and depth of traditional ethno-medicinal knowledge in addressing chronic inflammatory conditions such as rheumatism. Malik *et al.* (2021) are also of the opinion that plants are the best alternative source of drugs for treating musculoskeletal disorders.

Pharmacology: The medicinal species documented in the present study are strongly supported by existing pharmacological evidence, particularly regarding their anti-inflammatory potential. Seeds and bark of *A. indica* contain a range of bioactive compounds like astragalin, rutin, esculin, and especially aescin, which collectively contribute to its pronounced anti-inflammatory activity (Yadav *et al.* 2022). Similar properties have been reported for *A. acuminata*, whose anti-inflammatory effects are mediated through the suppression of key inflammatory mediators (Nisar *et al.* 2013). The major constituents' betulin and betulinic acid from *B. utilis* play a central role in treating inflammation (Loshali *et al.* 2025). *D. roylei* has also been demonstrated to exert notable anti-inflammatory effects (Yan *et al.* 2022), while the roots of *D. costus* have been analytically confirmed to possess strong anti-inflammatory properties (Elshaer *et al.* 2024). Evidences further indicate that *F. cymosum* effectively alleviates inflammation associated with arthritic conditions (Shen *et al.* 2013). Additionally, ferruginan isolated from *O. ferruginea* exhibits significant anti-inflammatory activity (Rauf *et al.* 2023). Compounds present in *T. repens* has suppressed inflammatory responses (Chen *et al.* 2019), likewise, *T. officinale* also demonstrated anti-inflammatory potential in it leaves (Jeon *et al.* 2008). The marked anti-inflammatory effects of *Rhododendron campanulatum* (Paudel *et al.* 2016) further reinforce the traditional therapeutic relevance of the species. Rheumatic disorders are characterized by inflammation of the joints, muscles, bones, and associated tissues. Together, these findings provide strong pharmacological support for the traditional ethnomedicinal use of the studied plants in managing inflammatory conditions.

Conservation obligations: The plant species recorded in the present study include taxa of varying conservation priority, ranging from Least Concern to Critically Endangered, thus highlighting the ecological and ethnobotanical diversity of the study area. Species such as *A. indica*, *B. utilis*, *T. officinale* and *Trifolium repens* fall under Least Concern category, yet their ecological roles in forest stabilization, soil fertility and local healthcare practices justify continuous monitoring to prevent prospective decline. In contrast, *A. acuminata* (Endangered) and *D. costus* (Critically Endangered) require urgent conservation intervention due to excessive harvesting for medicinal purposes, slow regeneration and shrinking habitat. Several other taxa including *D. roylei*, *F. cymosum*, *G. argentea*, *Iris kemaonensis*, *J. macrocephala*, *O. ferruginea*, *P. utilis*, *R. arvensis* and *R. campanulatum* lack clear assessment or have not yet been evaluated, indicating the necessity for population-based studies, cultivation trials and habitat-specific protection measures. Conserving these species is critical not only for sustaining traditional healthcare systems and livelihood security, but also for maintaining ecosystem resilience, pollinator networks, soil stability and overall Himalayan biodiversity under changing climatic scenarios. It has been understood that blending of relevant traditional knowledge and practices for developing strategies for climate change adaptation and mitigation have higher potentials to lead to sustainable solutions (Mukhopadhyay & Roy 2015).

Conclusion

This study documents a rich repertoire of traditional knowledge by documenting use of 15 medicinal plant species in the management of rheumatic disorders in Bhaderwah, Jammu and Kashmir, India. The results highlighted a community-driven pharmacopoeia that relies heavily on herbs particularly their roots and rhizomes; and demonstrates a sophisticated understanding of preparation and application

methods. Despite some overlap with earlier ethnobotanical surveys in the region, this focused investigation presents novel insights by examining the disease-specific knowledge systems. The use of quantitative indices *i.e.* Cultural Importance (CI) enhances our understanding of plant preference and perceived efficacy within the community. While some species like *A. indica* and *D. costus* enjoy high cultural significance, others are underutilized or possibly declining in use. Due to the pharmacological significance, these species are under the high pressure and some of them are placed under various threat categories of IUCN. Therefore, study emphasizes the urgent need for conservation of ethnomedicinal knowledge and biodiversity as well. Ultimately, the study bridges traditional and modern healthcare paradigms, advocating for integrative, sustainable and culturally sensitive approaches to chronic disease management.

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Ethno-Agrodiversity and Ethnobotanical importance of Millets in Western Madhya Pradesh (India)

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Abstract

Millets are rich in micronutrients, particularly Iron, Calcium, Magnesium, Phosphorous, Zinc, Potassium, Fibres and gluten-free along with low Glycemic index. They are useful for combating malnutrition and various day to day health problems. Landraces of millets are not the major part of commercial market, although they are grown regularly by farmers due to many reasons as crop for food, forage, medicine and other utilities and as essential and compulsory ingredient of pooja and offerings on various social and religious occasions and events. In present research paper, 7 accessions of Foxtail millet (*Setaria italica* L.); 5 accessions of Barnyard millet (*Echinochloa colonum var. frumentacea* (Link) Ridl.); 9 accessions of Small millet including Little millet (*Panicum sumatrense* Roth. with 5 Accessions), Kodo millet (*Paspalum scrobiculatum* L.) and Finger millet (*Eleusine coracana* Gaertn.) each with 2 Accessions and 7 accessions of Pearl millet (*Pennisetum glaucum* (L.) R. Br.) along with 28 local races of millets were collected and studied from five districts of western Madhya Pradesh. In foxtail millet (*Setaria italica*), 11 quantitative characters were assessed to document the extent of variation among its landraces. Similarly, in barnyard millet (*Echinochloa frumentacea*), 10 quantitative traits were studied, in little millet (*Panicum sumatrense*) 13 characters were recorded, and in pearl millet (*Pennisetum glaucum*), a total of 15 characters were analyzed, revealing wide variability across landraces. Such trait-based studies, also carried out in different parts of India, have consistently highlighted the genetic diversity conserved within traditional millet landraces.

Key Words: Millets, Landraces, Micronutrients, Forage, Medicine, Social, Religious, Accessions

Introduction

Millets are ancient, nutrient-rich grains with significant potential to combat malnutrition and lifestyle diseases. Despite their nutritional benefits, resilience to marginal growing conditions, and cultural importance, millet landraces remain underutilized in commercial markets. However, traditional farmers in regions like western Madhya Pradesh continue cultivating them due to their multipurpose utility as food, fodder, medicine, and their essential role in cultural and religious practices. Documentation and evaluation of these local landraces are crucial for conservation, utilization, and improvement of millet diversity. The erosion of traditional knowledge and farming practices has led to a significant decline in millet agrobiodiversity. To address this gap and support conservation efforts, this study aims to:

1. Collect and document local millet landraces from the study area;
2. Analyze the diversity of 28 accessions across six millet types;
3. Evaluate their nutritional, cultural, and agronomic value; and
4. Generate baseline information for future crop improvement and utilization programs.

Study area

Western Madhya Pradesh covers five districts, namely Alirajpur, Barwani, Dhar, Jhabua, and Khargone (Fig. 1). All the five districts are mostly populated (69.83%) by tribal people

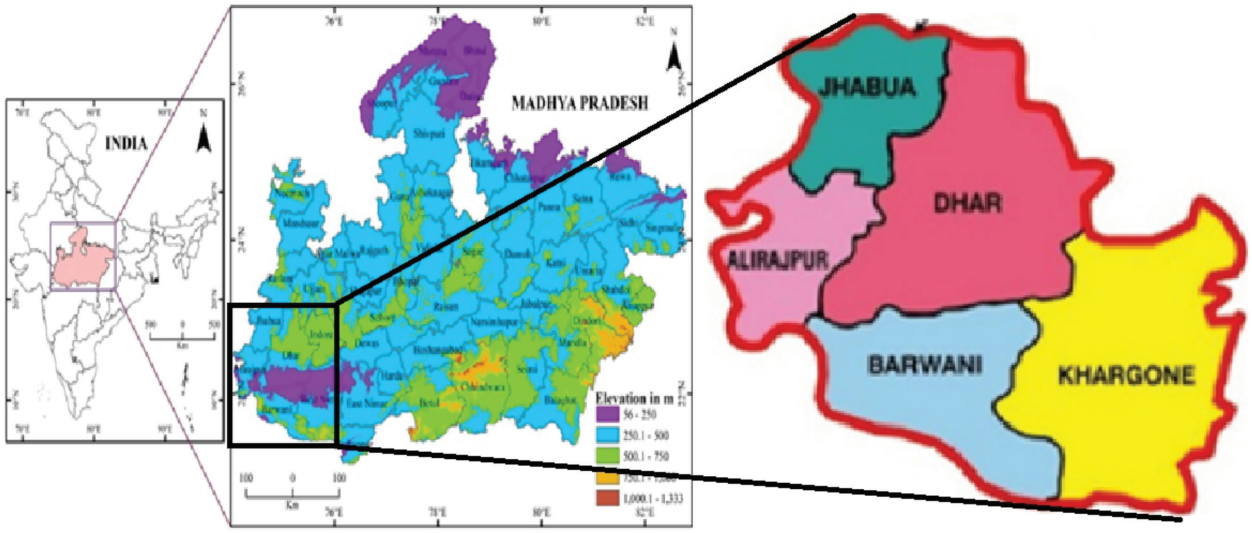


Fig. 1: Map of the study area

(census 2011). The main tribes in the study area are Bhil, Bhilala, Pateliya, Barela, Korku and Nihal. Most of the area is predominately engaged in agriculture. About 75% of the total population resides in the villages, in which 71% of the population are directly involved in agriculture (MoSPI 2023). Main crops are Sorghum, Maize, Rice, Wheat, Coarse Millet, Groundnut, Soya bean and Cotton.

Methodology

An extensive cross section survey of all the remotely located 105 villages was carried out to collect baseline information on agro-biodiversity of millets since September 2018 -2022. The data is accrued after discussions with the tribal farmers (Table-1).

Table 1: List of informants

S. No.	Name of Farmer	Yrs	Ethnic Group	S. No.	Name of Farmer	Yrs	Ethnic Group
1	Sakaram Kanoje	50	Barela	29	Rajendra	40	Pateliya
2	Kailash Sastiya	40	Barela	30	Nanli bai	50	Bhilala
3	Rupsing Sulya	58	Barela	31	Harish Ninama	32	Bhil
4	Mansham Bhabar	36	Bhilala	32	Rekha Bhanvr	32	Bhil
5	Nanuram	34	Bhilala	33	Hiralal	45	Bhil
6	Kalu	60	Barela	34	AmpiBai	25	Barela
7	Subhash Pachaya	38	Bhil	35	Dasra	50	Pateliya
8	Munnibai	55	Barela	36	Pratap Tadwale	28	Barela
9	Gangaram Jamriya	60	Barela	37	Nanla	58	Barela
10	Sayla baba	55	Barela	38	Theerbsingh	35	Korku
11	Uhribai	58	Bhil	39	Thavlibai	32	Korku
12	Bathibai	62	Barela	40	Cheemalal	38	Barela
13	Alamsingh	40	Bhil	41	Kuversingh	60	Barela
14	Dhursingh Khedkar	50	Barela	42	Govind Badole	55	Barela
15	Ramshaya	60	Bhil	43	Mangnya Sarpanch	55	Barela
16	Mishlibai	55	Barela	44	Devisingh Mehta	50	Barela
17	Dashrath Jadhav	54	Barela	45	Kalubaba	55	Bhilala
18	Vesta Waskale	40	Bhil	46	Kalarsingh sasatiya	56	Barela
19	Pyaribai	58	Bhil	47	Banchya	50	Bhilala

S. No.	Name of Farmer	Yrs	Ethnic Group	S. No.	Name of Farmer	Yrs	Ethnic Group
20	Raju Baghel	40	Bhilala	48	Aana	50	Barela
21	Mohan Waskale	25	Bhil	49	Premsingh	50	Bhilala
22	Hajariya	50	Bhil	50	Nana	60	Barela
23	Toophasingh	55	Bhil	51	Rama	62	Barela
24	Ramsingh	40	Bhil	52	Sudiibai	55	Barela
25	Bhagat	38	Bhil	53	Savita	22	Barela
26	Guhari	60	Bhil	54	Gabra	28	Barela
27	Baytibai	60	Bhil	55	Shari Bai	60	Barela
28	Narsingh	35	Bhilala	56	Nain Singh	55	Bhilala

Table 2: Quantitative analysis

Vegetative parts								Floral parts			
NL	PH	NBT	BFL	BFW	SFL	LP	PE	LI	BL	LF	WF
Seri bhadi	81	1	16	18	28	32	10	28	13	2.5	1.5
Bhadi	150	1	50	25	60	35	20	10	3	2	1.8
Sarvi bhadi	110	0	45	20	55	36	10	26	18	2.1	1.5
Chikni bhadi	99.09	1	40.64	2.54	30	40	10	30.48	12	2.5	1.5
Ralu	187.96	1	66.04	38	80	40	10	30.48	0	2.5	2
Kalibhadi	110	1-2	40	15	30	48	24	17	0	2	2
Ralbhad	145	1	45	25	30	28	13	18	10	2	1.5

Abbreviations : NL= Name of landraces, PL=Plant height (cm), NBT=Number of basal tillers, BFL= Blade of flag leaf length (cm), BFW= Blade of flag leaf width (mm) SFL=Sheath length of flag leaf (cm), LP= Length of peduncle (cm) PE=Peduncle exertion (mm), LI= Length of inflorescence (cm), BL= Bristle length (mm), LF= Length of fruit (mm), WF=Width of fruit (mm)

Table 3: Quantitative character

Vegetative parts									Floral parts	
NL	PH	NBT	FL	BGW	SF	LP	LI	WI	NRPI	LLR
Battigulabi	104	5	40	18	15	16	14	40	18	17
Barti kudari	90	2	35	15	14	10	13	35	10	12
Battisat chatri	147	3	46	25	16	20	11	30	8	30
Barati thupi	158	5	45	20	17	20	15	45	24	20
Vatti	130	8	40	22	10	35	18	50	26	35

Abbreviations: NL= Name of landraces, PH=Plant height (cm), NBT=Number of basal tillers, FL=Blade of flag leaf length (cm), BGW=Blade of flag leaf width (mm), SF=Sheath length of flag leaf (cm), LP=Length of peduncle (cm), LI=Length of inflorescence (cm), WI= Width of inflorescence (mm), PRPI=Number of racemes per inflorescence, LLR Length of lower racemes (mm)

In foxtail millet, 11 quantitative characters were studied to record the variations among its landraces. None of these millets are being sold by tribal in their market because these varieties are cultivated due to their own custom and cultural values (Table-2). However, in Barnyard millet (Table-3), total 10 quantitative characters and their variations were studied. As far as small millet is concerned (Table-4), 13 quantitative characters were observed and variations among all the landraces were recorded. Among the landraces of pearl millet (Table-5), total 15 quantitative characters were studied along with their range of variations and it is original information collected for the first time and the ethnobotanical importance is reported from the study area (Table-6).

Table 4: Quantitative Characters

Vegetative parts									Floral parts				
NL	PH	BT	FL	BGW	SF	LP	PE	LI	BPI	NPNI	NSI	LF	WF
Lefdi vari	104	3	30	8	10	14	50	28	8	5	3	4	3
Sangari	142	7,8	41	10	7	18	45	30	7	7	5	2	1
Kutki Mure	110	6,7	35	10	12	28	14	25	7	7	0	1	.5
Kodri	73	4,5	32	10	9	13	50	20	4	1	2	2	1
Vorati	150	4,5	40	10	12	15	60	35	13	8	3	4	3
Kudru	64	1	37	10	17	7	40	70	5	5	0	5	3
Kodra	64	1,2	31	10	17	6	40	7	1	1	0	5	3
Bavto	60	3	10	10	2	4	5	4	6	7	0	2	1
Mandua	110	2	32	11	16	8	35	7	5	6	0	2	1

Abbreviations : NL= Name of landraces, PH=Plant height (cm), BT=Number of basal tillers, FL=Blade of flag leaf length (cm),BGW=Blade of flag leaf width (mm)SF=Sheath length of flag leaf (cm),LP=Length of peduncle (cm),PE=Peduncle exertion (mm),LI=Length of inflorescence (cm), BPI=Number of branches of primary inflorescence, NPNI= No. of nodes on which primary inflorescence present, NSI=Number of branches of sec. Inflorescence, LF=Length of fruit (mm),WF= Width of fruit (mm)

Table 5: Quantitative characters

Vegetative parts											Floral parts				
NL	PH	ST	TT	NT	PT	LL	LW	LN	SL	IL	SPL	STh	EED	RD	ISL
Haldiya Bajri	110	4	2	2	2	48	2.5	4	12	18	22	90	9	3	3
Burayu bajru	333	6	8	4	8	64	50	10	13	22	28	50	5	4	5
Kuthari bajri	183	4	14	16	10	58	18	15	16	28	10	80	10	3	4
Datray bajri	220	4	3	1	3	46	20	4	12	20	15	30	10	4	2.5
Emli bajri	140	3	1	0	1	48	30	4	15	21	19	85	8	3	3
Khicdu bajru	284	6	28	12	20	72	70	11	14	22	28	11	5	4	4.5
Muchava bajra	333	5	18	8	12	78	60	10	12	26	24	12	6	4	5

Abbreviations: NL=Name of landraces, PH=Plant Height(cm),ST=Stem Thickness (mm),TT=Total tillers NT=Nodal tillers, PT=Productive tillers, LL=Leaf Length (cm),LW=Leaf Width (mm),LN=Leaf Number, SL=Sheath length (cm),IL=Internodes length (cm), SPL=spike length (cm), STH =spike thickness (mm),EED=Ear exertion distance(cm), RD=Rachis diameter (mm), ISL= Involucre stalk length (mm)

Table 6: Ethnobotanical importance of Millets in the study area

Millet Type	Landrace Name	Voucher specimen number	Ethnobotanical importance	Socio-religious importance
Foxtail Millet	Seri bhadi	160	Grains cooked and consumed with milk, consumed to cure chicken pox.	Pasted on traditional musical instrument 'Mandal' skin during funereal cremation and various occasions
	Bhadi	320	Grains cooked as rice, straw used as fodder	Used as invitation on tradition religious rituals like 'Indal'.
	Sarvi bhadi	480	Cure skin infection, Lactating mother, to cure boil on scalpel of the newly born child.	Grains used in 'Jalwa poojan'

Millet Type	Landrace Name	Voucher specimen number	Ethnobotanical importance	Socio-religious importance
	Chikni bhadi	550	Post-natal tonic for women	Grains consumed during various festivals and ceremonies.
	Ralu	640	Strengthen bones, Fodder to increase milk in animals. Used for making of baskets, mats and thatching of roof	Grains used in 'Jalwa poojan'
	Kalibhadi	196	Cure fever and headache, cholera.	Traditional recipe offered to god as oblation
	Ralbhad	112	khichdi, bhakari, bread traditional food and nutritive for women and child	Grains used during Kuldevi poojan
Barnyard Millet	Battigulabi	128	Consumed as rice, Rabadi and kulaya	Grains used during Babdev pooja
	Barti kudari	144	Consumed during fasting, straw for mud wall, earthen pot.	----------
	Battisat chatri	161	Consumed as rice, upma, given to women after delivery, *Khichdi* for stomach disorders	Grains accepted as invitation and eaten during religious ceremony and fast.
	Barati thupi	321	Chakli, Sakarpara and Papadi preparation etc.	---------
	Vatti	441	Low blood pressure and jaundice.	Traditional dish "kheer" offered during cultural ceremonies
Small Millet	Lefdi vari	258	Sheera/ Bhogni	Grains cooked and eaten on Nag Panchami
	Sangari	159	As rice consumed with chilly, easy digestion	Grains used in 'Jalwa poojan'
	Kutki Mure	148	With Jaggery to make sweet ball,	Grains used in 'Jalwa poojan'
	Kodri	147	As rice eaten with pulse, kheer, for making earthen pots, chulha, and wall of huts	Consumed during religious and ceremonial fasts.
	Vorati	259	Used as rice and porridge	Consumed during religious and ceremonial fasts.
	Kudru	369	Cooked as Chapatti, Papad, pakoda and vada; strengthen bones, used as fodder and animal feed	---------
	Kodra	321	Cooked as rice, Chakli,	novel food and for cultural symbols, 'Mandal' skin paste
	Bavto	654	Make liquor, livestock feed.	Sacred crop for honouring deities
	Mandua	650	'Roti and Chilra' treating liver disorders and asthama	---------
Pearl Millet	Haldiya Bajri	287	Staple food, bread, and khichda, fodder of cattle and goat	As "Khichda" used in engagement ceremonies

Millet Type	Landrace Name	Voucher specimen number	Ethnobotanical importance	Socio-religious importance
	Burayu bajru	156	Chapati, cattle fodder, thatching, domestic fuel	---------
	Kuthari bajri	354	Fodder for cattle, cow and buffalo	As Khand given to oxen on Diwali festival.
	Datray bajri	600	Making of chapatti, Jhadbhujia	As food during traditional ceremonies.
	Emli bajri	452	As green fodder for cattle	For women on Jalwa ceremonies
	Khichdu bajru	492	Traditional dish 'khichada' and chapatti	---------
	Muchava bajra	521	As khand for oxen on Diwali, fodder for cattle	Engagement ceremony

Methodology suggested by Jain (1977) is followed. The taxa have been identified with standard literature (Varma *et al.* 1993; Mudgal *et al.* 1977; Samvatsar 1996; Singh *et al.* 2001; Sinha & Shukla 2007). Format for description of the plant was designed according to International Board for Plant Genetic Resources (IBPGR) 1985 for Foxtail millet (*Setaria italica* L.), IBPGR 1983 for Barnyard millet (*Echinochloa frumentacea* L.), IBPGR 1985 for Proso millet (*Panicum miliaceum* L.) and Little millet (*Panicum sumatrense* Roth.), IBPGR 1983 For Kodo millet (*Paspalum scrobiculatum* L.), and IBPGR & ICRISAT, 1993 for Pearl millet (*Pennisetum glaucum* L.). Photographs were snapped and the plants were deposited in herbarium of Pradhanmantri College of excellence, S. B. N. Govt. P. G. College, Barwani, Madhya Pradesh, India and voucher specimen numbers are given in Table -6.

Results and Discussion

Foxtail millet, Barnyard millet, Small millets, Pearl millet are essential ingredient of various recipes for example, 'Chapati', 'Chilra', 'Chawal', 'Khichdi', 'Rabadi', 'Chakli', 'Sakarpara', 'Papad', 'Papadi' 'Bhakari', 'Pakoda', 'Jhadbhujia', 'Sheera', 'Bhogni', and 'Sattu' (Indian fast food) as shown in Table 6. Nutritious food 'Daliya' of millet is in high demand in 'Anganwadis'.

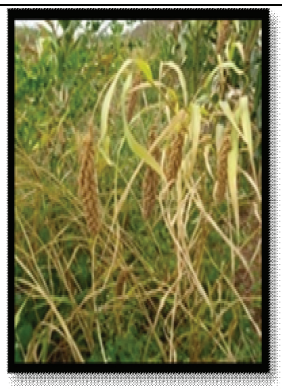
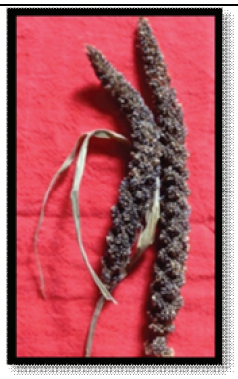
Millets serve as ethnomedicines for treatment of ailments in humans, animals, and poultry, while also functioning as an economic crop widely utilized in household and agricultural practices. The identified local millet varieties—Seribhaadi, Chikni Bhaadi, Kali Bhaadi, Sangawawri, Muchhwa Bajra, and Kuthari Bajra—though limited in yield potential, exhibit remarkable attributes such as superior nutritional value, desirable cooking qualities with characteristic aroma, and strong resilience to pests, diseases, and adverse climates (Plate 1).

These diverse local varieties of millets, with novel and excellent characters not only plays a vital role in sustaining ecological balance by supporting climate-resilient farming systems but also contributes directly to achieving Sustainable Development Goals (SDGs) such as zero hunger (SDG 2), good health and well-being (SDG 3), responsible consumption and production (SDG 12), and climate action (SDG 13). Thus, systematic documentation and evaluation of millet landraces are critical for strengthening food security, enhancing rural livelihoods, and ensuring sustainable agro ecosystems.

The different traditional system of agriculture and indigenous method of maintaining soil fertility, socio-cultural and religious rituals have saved many crops that are under threatened category. Synchronizing Biodiversity Conservation with culture is the attitude of the tribal farmers towards their traditional practices. There exists a symbiotic relationship between biological diversity and cultural diversity. The findings of present study highlight the importance of conserving and promoting millet landraces as a sustainable alternative for nutrition security, climate-resilient agriculture, and livelihood enhancement. Future research should focus on their genetic improvement, wider cultivation, and integration into policy frameworks to align with food security and sustainable development goals. They are the treasure house of several novel and excellent genes, and can be genetically screened and used for plant breeding projects.

Conclusion and Recommendations

The conservation of local millet races is deeply rooted in traditional farming systems, indigenous soil fertility management, and socio-cultural rituals, which together reflect the symbiotic relationship between biodiversity and cultural diversity. Following recommendations are suggested based on the results of present study:

			
FSD-1 Seri bhadi	*FSD-02 Bhadi*	*FSD-03 Servibhadi*	*FSD-04 Chikni bhadi*
			
FSD-05 Ralu	*FSD-06 Kalibhadi*	*FSD-07 Ralbhad*	*BSD-01 Battigulabi*
			
BSD-02 Barti kudari	*BSD-03 Battisat chatri*	*BSD-04 Barti thupi*	*BSD-05 Vatti*
			
SMSD-01 Lafdi vari	*SMSD-2 Sangari*	*SMSD-03 Kutkimure*	*SMSD-04 Kodri*

1

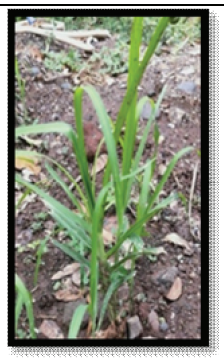
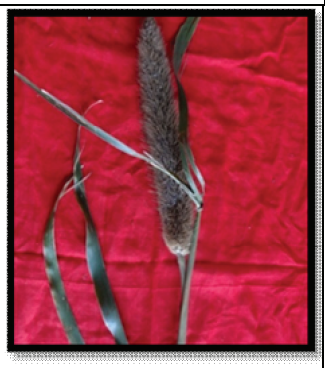
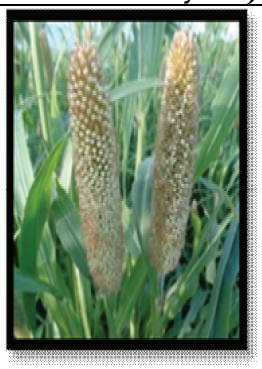
			
SMSD-05 Vorati	***KMSD-01 Kudru***	***KMSD-02 Kodra***	***WKMSD-01 Bavto***
			
FMSD-01 Mandua	***PSD-01 Haldiyabajri***	***PSD-02 Burayubajru***	***PSD-03 Kuthari bajri***
			
PSD-04 Datray bajri	***PSD-05 Emlibajri***	***PSD-06 Khichdu bajru***	***PMSD-07 'Muchava bajra'***

Plate 1: Different land races of millets recorded in the study area

1. Conservation and Documentation – Systematic documentation and on-farm conservation of millet landraces should be prioritized to prevent genetic erosion.
2. Value Addition and Promotion – Development of value-added millet products can enhance marketability and strengthen local economies.
3. Policy Integration – Inclusion of millet biodiversity in agricultural and nutrition policies will support food security and climate-resilient farming.
4. Community Participation – Empowering tribal farmers through participatory approaches ensures synchronization of biodiversity conservation with cultural heritage.
5. Research and Development – Genetic improvement, characterization, and sustainable utilization of these landraces should be taken up to align with Sustainable Development Goals (SDGs).

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Ethnobotanical investigations on the Chhath Festival observed in Eastern India

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Abstract

'Chhath' is a winter festival observed around rivers, tanks and other water bodies in the states of Bihar, Jharkhand, West Bengal, eastern Uttar Pradesh as well as Terai regions of Nepal in the bright fortnight of Indian calender month of **Kartik** (October-November). The festival is dedicated to the worship of Sun God in which there is a communion with Sun, the eternal source of energy on our planet earth. No priests are essential to perform any ritual. All rituals during the Chhath festival are carried out by the family members only. The festival is related with cleanliness and tranquility. **Chhath** involves the use of plants like: bamboo, sugarcane, coconut, banana, bamboo, betel, betel nut, turmeric, ginger, sweet lime, lesser yam, water chestnut, sweet potato etc. Baked clay items are an essential ingredient of this festival. The festival has now taken the shape of a pan Indian and pan global event. Milkweed **('Akwan')** is an essential item during this festival from which '**Aartak Paat'** is made and used. The festival signifies a strong bond with the water bodies which constitute the life line of the region. Efforts are being made to procure the recognition of this festival as an Intangible World Heritage site under UNESCO. Uniqueness of the event lies in the fact that a longing is expressed for a female child as well.

Key Words: Chhath, Bihar, Jharkhand, tropical fruits, bamboo, sugarcane, coconut, banana, milkweed, lesser yam, shaddock

Introduction

'Chhath' basically means a ritual observed on the 6th instant of the ***Shukla Paksha*** (bright fortnight) of the Indian calendar month of Kartik (Oct–Nov). On this day in the evening **Arghya** (oblation) is offered to the setting sun. Morning '**Arghya'** is offered on the following day of Saptami (7th the instant) and with this the festival comes to an end. The '**Prasad**' is consumed by the devotees and other members of the kin.

Chhath is basically a 4-day festival that starts with the 4th instant. The day is called Nahay-Khay *i.e.*, one takes food made of un-parboiled rice with **Kaddoo/Sajmani** as the cooked vegetable. This is done after taking bath in a water body. On the 5th instant the devotees keep fast for the whole day and take food without salt in the evening after offering 'Prasad' to the deity. This second day is called **'Kharna'**.

Methodology

A detailed survey was made of the plants and other worship items associated with the 'Chhath' festival in Mithila region of the northern Bihar and the adjoining Terai regions of Nepal. Findings have been presented in the form of one plate containing six figures and one Table 1.

Discussion

Chhath could be held as a traditional festival that facilitates the conservation and sustainable use of tropical fruits, underground vegetables and the spices (Singh *et al.* 2016). Figures in Plate-1 provide a visual glimpse of the practices observed during the festival. Fig. 1 shows the observance of the festival along side the river Ganges in Patna, the state capital of Bihar. Fig. 2 shows the 'Arghya' items spread over the Ganga ghat. Fig. 3 provides the glimpse of Bihari migrants in the national capital at Delhi observing the festival

in a small pond dug on this occasion. Fig. 4 shows migrant devotees performing Chhath in the froth ridden Yamuna river in the national capital city during the winters of 2024. Fig. 5 shows folk singer late Sharda Sinha receiving Padmshree award from the then President of India. Fig. 6 shows sugarcane stalks raised alongside a Chhath ghat in Darbhanga district in Bihar.

Table-1 enlists the various plant items used in Mithila region during Chhath festival. The two major cereals-rice and wheat- are of special importance. It is generally the red coloured rice called **'Gamhari'** that is used for making **'Bhuswa'** (a sweet made from powdered rice). The other sacred cookie used on this occasion is **'Thekua'** that is made from wheat flour cooked in 'Ghee' and mixing 'Saunf' (fennel)

Plate 1

Fig. 1: "Chhath Puja performed on the bank of river Ganga in Patna alongside the lateral flyover"

Fig. 2: "Items offered at Chhath ghat"

Fig. 3: "Small Pond raised for Chhath festival in the Seemapuri area of Delhi"

Fig. 4: "Devotees in the national capital Delhi performing Chhath Puja in river Yamuna"

Fig. 5: Smt. "Sharda Sinha being honoured with the Padma award by the then President Sri Ram Nath Kovind."

Fig. 6: "Sugarcane stalks raised in the Rajokhari of village Keoti in Darbhanga district of Bihar."

Table 1: Plants and their items used on the occasion of Chhath festival in Mithila of North Bihar

Botanical Name	Family	Local Name	English Name
Oryza sativa L.	Poaceae	'Chaval'	Rice
Triticum aestivum L.	Poaceae	'Gehum'	Wheat
Areca catechu L.	Arecaceae	'Supari'	Arecanut
Bambusa sp.	Poaceae	'Bans'	Bamboo
Cocos nucifera L.	Arecaceae	'Nariyal'	Coconut
Calotropis procera (Aiton) Dryand	Apocynaceae	'Akaun'	Milkweed
Curcuma domestica Valet.	Zingiberaceae	'Haldi'	Turmeric
Euryale ferox Salisb.	Nymphaeaceae/ Euryalaceae	'Makhana'	Gorgon nut
Musa sapientum L.	Musaceae	'Kera'	Banana
Piper betle L.	Piperaceae	'Paan'	Betel
Pisum sativum subsp. *arvense* (L.) Poir.	Fabaceae	'Kerao'	Pea
Saccharum officinarum L.	Poaceae	'Kusiyar'	Sugarcane
Zingiber officinale Rosc.	Zingiberaceae	'Aad'	Ginger
Citrus maxima (Burm.) Merr.	Rutaceae	'Tabh Nebo'	Shaddock
Raphanus sativus L.	Brassicaceae	'Murai'	Radisa
Dioscorea esculenta (Lour.) Burkill	Dioscoreaceae	'Suthni'	Lesser Yam
Lagenaria siceraria (Molina) Standl.	Cucurbitaceae	'Sajmani'/'Kaddoo'	Gourd
Mangifera indica L.	Anacardiaceae	'Aam'	Mango
Cicer arietinum L.	Fabaceae	'Chana'	Gram
Colocasia sp.	Araceae	'Arui'	Taro
Basella rubra Stewart	Basellaceae	'Poro saag'	Malabar spinach
Trapa natans var. bispinosa (Roxb.) Makino	Trapaceae	'Singhara'	Water chestnut

with the same. **'Khaja'** an ancient sweet of the area is also offered essentially on this occasion. The festival gains significance in the fact that on this occasion a longing is expressed for having a girl child as well. This is very much expressed in the folk songs sung during this occasion. The late folk singer Sharda Sinha gained enormous popularity for singing Chhath songs in her mother tongue 'Maithili' and also in 'Bhojpuri'. Chhath songs have made her immortal in other countries where Biharis migrated a few centuries back. No wonder, she was honoured with national Padma award by Sri Ram Nath Covind ji the then President of India.

Late Smt. Sharda Sinha was conferred the awards *viz*.: Padmshree and Padmabhushan during her life time. Padma Vibhushan was also conferred upon her posthumously. It was a coincidence that she died in October, 2024 during Chhath festivities itself. She was a teacher of music under L.N. Mithila University, Darbhanga (Bihar).

The festival is essentially related with cleanliness as the ghats and the ways/roads leading towards the ghats are thoroughly cleaned by the devotees. Another aspect is the sense of communal harmony it bestows. It has been found that even Muslims perform the rituals of this festival after their wishes are fulfilled. Muslim women in Patna carve the earthen stoves ('Chulhas') by observing all the associated pre-conditions – they observe fast and refrain from taking non- vegetarian food and avoid onion and garlic food during this period of festival. The period witnesses minimum law and order situation. Entire social order during Chhath gets oriented towards the spirituality.

Devotees prepare sacred 'Prasad' on earthen 'Chulhas' by using generally the mango wood and dung cakes as fuel. Traditional jaggery is preferred in place of sugar for making the cookies. Fruit traders also earn a hefty income by selling fruits like coconut, banana, shaddock etc. 'Chinia kera' (having its origin in China) does have a roaring business during Chhath festival.

Ripened inflorescence, locally called 'Ghaund'/'Ghaur' is a common sight during this festival. Hazipur area on the left side of river Ganges is famous for its 'Chinia' variety of banana. Underground food items like radish, turmeric, ginger

and lesser yam ('Suthni') are essentially offered during this festival. One highly significant item on this occasion is 'Kerao' (*Pisum sativum* var. *arvense*) that is placed in the bamboo utensils containing the offerings spread over at ghats and its swollen / germinated form is distributed to all the members of the kin. 'Kerao' is distributed on other occasions like 'Shraddh' also. There is a need to investigate the antiquity of 'Kerao' with Mithila rituals.

A sizeable section of the native populace in Bihar, Jharkand and eastern Uttar Pradesh migrated to metropolitan and other cites in search of jobs and other works. These migrants now have settled down to their new places since decades and find it convenient to observe the festival there itself.

Keeping in view the coherence of these 'Chhath' observing migrants, a new term 'Poorvanchali' is now in vogue as they have emerged a potent social group. State Government of Delhi now declares holiday on this occasion. 'Chhath' is now observed on sea coasts by those residing in metro cities like Mumbai, Chennai, Kolkata and other coastal cities as well.

Chhath festival, besides establishing a communion with the only visible deity like 'Sun' also helps strengthen the rural economy. It provides a basis of livelihood to the 'Kumhar' (pot makers) and 'Dom' communities. The pot makers carve items like 'Haathi' (elephant), single and 4-cornered (**Chaumukh)** earthen lamps and earn money through their sale. Dom community (a scheduled caste) earns significantly by carving items like 'Chhitta'/'Daura', 'Koniya', 'Changeri', and 'Dala' etc. These items are used for winnowing the grains during and after harvest of paddy and other crops.

The festival is observed alongside of rivers. tanks, ponds, dams and other natural and man-made aquatic bodies. Those who can not afford to move outside their homes dig temporary ditches and store water in the same. They adorn the freshly dug water body with banana pseudo-stems containing their green leaves intact. This helps create a serene fervour during the Chhath festival. Thereafter these sected banana plants are floated in the water body itself and this helps the cleaning of water. Last few years have witnessed the Govt. of Bihar constructing **Pucca ghats** alongside of the water bodies. Banana pseudo-stem and its juice act as natural coagulant. Their polysachharide contents remove turbidity, suspended solids and chemical oxygen demand from polluted water by forming flocks for easier settling. The process works as pre-treatment or supplement to conventional methods due to its eco-friendly and low cost nature (Alwi *et al.* 2013) There is a practice in certain cross sections of people to eat cooked greens of 'Poro' (*Basella rubra*) after completing the morning '***Arghya'*** (Singh *et al.* 2024).

The festival is aimed at maintaining a deep sense of social coherence as the people belonging to upper caste hierarchy do not hesitate to engage those belonging to lower hierarchy for performing the 'Pooja' and offering 'Arghya'.

Another festival called "Sama Chakeba" starts in the evening of the 6th instant and runs up to the night of Kartik Purnima (last instant of the bright fortnight of Kartik month). It is basically an occasion for welcoming the migratory birds that start thronging the water bodies and ploughed fields in the region around this time. Women fondly relish this 10-day festival of "Sama Chakeba" during evening.

'Arta' or Aartak Paat, literally meaning the leaves of a weed called Akaun (*Calotropis procera)* is a significant item during this festival (Jha *et al.* 2013). This latex bearing weed has been a source of bast fibres since ancient times (Varshney & Bhoi 2013). Certain villages in Saran district of Bihar are major centers of production of 'Aartak Paat' where a rural cottage industry runs on it.

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Bhili folk songs: Ethnobotanical approach

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Abstract

Folk songs and dances are integral part to the Bhil tribals of Ratlam district in Madhya Pradesh, serving as key forms of recreation. Some folk songs are exclusively on plants, based on single species or a number of species; while many folk songs focus on themes like agriculture, famine, love, marriage, religion, recreation and liquor, with references to plants. This study highlights, 14 folk songs revealing 26 plant species from 26 genera belonging to 22 families.

Key Words: Bhil tribe, Folk songs, Ethnobotany, Ratlam, Madhya Pradesh

Introduction

Plants play an integral part in the daily life and culture of the Bhil tribes in Ratlam district, Madhya Pradesh. Folk songs reflect the plants found in the region and highlight their uses in various aspects of life, including agriculture, famine, love, marriage, religion, recreation, liquor etc. Chorus songs, often accompanied by musical instruments and dance, are prevalent, especially in celebrations like births, marriages and festivals. The district lying between $23^0$05'–$23^0$55' N latitude and $74^0$30'–$75^0$42' E longitude covers an area of 4861 sq. km. The district is situated on Malwa plateau at 493.62 m. above the sea level. According to 2001 census the population of Bhil tribe in the district was 2.26 lac constituting about 23.27% of the total population.

Ethnobotany has introduced numerous little-known or unknown uses of plants (Jain 1981, 1991, 2004, Nautiyal and Kaul 2003). But there has not been detailed depth study about the ethnobotanical observation on wild plants used in folk songs and folk dance (Agrawal 1997; Joshi 1995; Patil; 2018, Singh 1971). The author is engaged in ethnomedicinal investigations in this district, results of which have been published (Jadhav 2012, 2013, 2014) earlier. Previous studies have explored ethnobotanical uses of plants, but this paper specifically examines the relationship between wild plants and Bhil folk songs. Present survey revealed that *Ailanthus excelsa* (Aydu ba), *Bombax ceiba* (Semal), *Syzygium cumini* (Jamun) and *Madhuca indica* (Mahua) are the main species on each of which several songs are prevalent among bhil tribes of the district. Presently, 14 folk songs have been investigated from ethnobotanical perspective.

Methodology

Extensive field trips were organized for collecting the plant species and data using an integrated approach of botanical collections interviews and questionnaires. In Bhil tribe or village usually there is one elder person familiar with the use of surrounding plants, and is local physician who is called "Bhopa". "Bhopa" was contacted and taken to the field for collecting information about plant name included in the folk songs. Herbarium specimens prepared following the standard method (Jain & Rao 1978) have been deposited in the herbarium of Botany department, Govt. Arts & Science College, Ratlam (MP). Herbarium specimens were identified with the help of standard flora (Mudgal *et al.* 1997; Verma *et al.* 1993; Singh *et al.* 2001).

Enumeration

Some beautiful examples of Bhili folk songs are:

(1)

ऊंचो ***मऊड़ों*** भाई डारो ऊँदों भाई
डारो ऊँदो भाई हाथलों ऊँदों भाई
उँडे भैराणु भाई

हाथलो ऊँदों भाई ***मऊड़ों*** ऊँदों भाई
मऊड़ों ऊँदों भाई बिनवा वालों उँदों भाई

बिनवा वालो ऊँदों भाई
तोकवा वालों ऊँदों भाई
तोकवा वालो ऊँदों भाई

उतारवा वालों ऊँदों भाई
उतारवा वालों ऊँदों भाई
गारवा वालों ऊँदों भाई

गारवा वालों ऊँदों भाई
नलियों ऊँदों भाई
उण्डे भराणु भाई
नलियों ऊँदों भाई भभेरो ऊँदों भाई
उण्डे भराणों भाई
भभेरो ऊँदों भाई दारू ऊँदों भाई
उण्डे भराणु भाई

दारू ऊँदों भाई साकवा वारों ऊँदों भाई
उण्डे भराणु भाई
दारू ऊँदों भाई पिवा वारो ऊँदों भाई
उण्डे भराणु भाई

दारू पिनी डोफाई किदो डोफाई हरकु थाईथुँ भाई
उण्डे भराणु भाई
दारू पिनी डोफाई किदी चारा भईरा चुटाँ भाई
उण्डे भराणु भाई ।

'**Uncho mauwro (***Madhuca indica* Gmel., Sapotaceae, 'Mawdo'**) bhai daro undo bhai…**' This song quite picturesquely shows that right from collecting the intoxicating Mahua flowers to brewing the liquor, there is a suggestion of turning upside down. Hence whosoever drinks the Mahua-wine turns tipsy and is ruined.

(2)

माहरे आगणी हैं लिली ***लिमोड़ी*** ने जाड
माहरे आगणी हैं लिली ***लिमोड़ी*** ने जाड
गुरूजी आवता था छाया बैठता था।

माहरे आगणी हैं लिली ***लिमोड़ी*** ने जाड
गुरूजी आवता था दुणीये सेवता था
माहरे आगणी हे लिली ***लिमोड़ी*** ने जाड
गुरूजी आवता था भजन बोलाता था
माहरे आगणी हे लिली ***लिमोड़ी*** ने जाड
गुरूजी आवता था सेला बैठता था

माहरे आगणी हे लिली ***लिमोड़ी*** ने जाड
गुरूजी आवता था सेवा करता था
माहरे आगणी हे लिली ***लिमोड़ी*** ने जाड।
गुरूजी आवता था सेवा करता था

'**Mahre angdi he lili limodi** (*Azadirachta indica* A. Juss., Meliaceae, 'Limdo')…Bhils sing this song wherein it is explained that bounteous canopy of *Azadirachta indica* (Limdo) provides deep shade.

(3)

लीलो ***आंबो*** पीली केरी मोजावाला चोरा
जातो जातो केरी खातो जाजे मोजा वाला चोरा

लीलो ***आंबो*** गेरी चांय मोजावाला चोरा
जातो जातो चांया बैठो जाजे मोजा वाला चोरा

लीलो ***आंबो*** गेरी वाईरी मोजावाला चोरा
जातो जातो वाईरी खातो जाजे मोजा वाला चोरा

लीलो ***आंबो*** मीठी केरी मोजावाला चोरा
जातो जातो केरी खातो जाजे मोजा वाला चोरा

लीली अमडी लीली केरी मोजावाला चोरा
जातो जातो केरी तोड़तो जाजे मोजावाला चोरा

लीला आंबानी लीली मानडीये मोजावाला चोरा
जातो जातो अम्र कर तो जाजे मोजावाला चोरा।

'**Lilo ambo** (*Mangifera indica* L., Anacardiaceae, 'Ambo') **pili keri…**'Bhils sing this song wherein it is explained that bounteous canopy of *Mangifera indica* (Ambo) produces sweet fruits and provides shade.

(4)

हेडे ***हिमलीये*** रम्तो फुल-फुल में हिरो रमतो तो
मारी जोड़ी पुसे ते इम केजे दोस्त हंडे रमतो तो

हेडे ***हिमलीये*** रम्तो फुल-फुल में हिरो रमतो तो
मारी सहली पुसे तो इम केजे स्कुल में पडाई करतो तो

हेडे ***हिमलीये*** रम्तो फुल-फुल में हिरो रमतो तो
मारी भाभी पुसे इम के जे भाई के साथ खेलतो तो

हेडे ***हिमलीये*** रम्तो फुल-फुल में हिरो रमतो तो
मारा गुरू पुसे इम के जे राम की माला जपतो तो

हेडे ***हिमलीये*** रम्तो फुल-फुल में हिरो रमतो तो
मारा दोस्त पुसे ते इस किजे बचा के हडे रमतो तो।

'Hede himliye (*Bombax ceiba* L., Malvaceae, 'Hemlo'**) ramto…**'. The song speaks of the young Bhils earnest wish to while away his time playfully under the beautiful, shady and flowery 'Semal' tree and his very many excuses not to go home.

(5)

डुंगरी पीताँ ***अडुओ बापा*** बोरिया वणी ना जाऊँ बापा
होराजी मारो दाकलो दीये बोरिया वणी ना जाऊँ बापा

डुंगरी पीताँ ***अडुओ बापा*** साकली वणी ना जाऊँ बापा
हऊजी मारी दाकलो दीये साकली वणी ना जाऊँ बापा

डुंगरी पीताँ ***अडुओ बापा*** दोइडि वणी ना जाऊँ बापा
जेठाणी मारी दाकलो दीये दोइडि वणी ना जाऊँ बापा

डुंगरी पीताँ ***अडुओ बापा*** कन्दरा वणी ना जाऊँ बापा
जेठजी मारो दाकलो दीये कन्दरा वणी ना जाऊँ बापा

डुंगरी पीताँ ***अडुओ बापा*** तोडिला वणी ना जाऊँ बापा
मोठीजी मारी दाकला दीये तोडिला वणी ना जाऊ बापा

डुंगरी पीताँ ***अडुओ बापा*** विसिया वणी ना जाऊँ बापा
मोठोजी मारो दाकला दीये विसिया वणी ना जाऊ बापा।

'Dungri pitan aduo (*Ailanthus excelsa* Roxb., Simaroubaceae, 'Aydu ba'**)…**'. Through this piece of folk song the daughter makes out her tragic situation at her in-laws. That her in-laws press her unduly as to collect ornaments like Todi and so on from her father's house or they will kick her out. Hence she is unwilling to go to her in-laws.

(6)

घड़ी आलो घड़ी आलो, कामड़ी घड़ी आलो रे।
पड़िया कोरे काले, मामा तीर घड़ी आलो रे।

सपनिया हरको काले, मामा तीर घड़ी आलो रे।
नदियाँ टूटा नीर, मामा तीर घड़ी आलो रे।

कोठार खूटा धाने, मामा तीर घड़ी आलो रे।
खांणां खूटा ***महुआ***, मामा तीर घड़ी आलो रे।

मगरा खूटो सारो, मामा तीर घड़ी आलो रे।
लक्ष्मी मरवा लागी, मामा तीर घड़ी आलो रे।

मानवी मरवा लागा, मामा तीर घड़ी आलो रे।
छोरा मरवा लागा, मामा तीर घड़ी आलो रे।

'Ghadi alo ghadi alo…' Some of the tribal songs paint the famine stricken life and the young Bhils desperate desire to make use of bow and arrow and that way to rob and loot. Mahua (*Madhuca indica* Gmel., Sapotaceae, 'Mawdo').

(7)

आमली ने डोरे मोरीलु बोले
आमली ने डोरे मोरीलु बोले

वाटना वटारूं कूरे वीरां
एक हन्देड़ो लेतो रे जाजे

म्हारा रे बापा ने इम जईने केजो
तम्हारी रे डीकी ले कुंवर जमलियो

सावड़ सन्द्रडीली ने वेला रे पधारो
आमली ने डोरे मोरीलु बोले

वाटना वटारूं भाई कू रे वीरां
एक हन्देहो लेतो रे जाजे

म्हारी माड़ी ने इम जईने केजो
तम्हारी डीकी ने कुंवर जमलियो
सावड़ सुन्दरी लई ने वेलारे पधार जो।

'**Amli** (*Tamarindus indica* L., Caesalpiniaceae) **ne dore morelu**…'Tree as a fine messenger to break the price of news to her parents that she has been gifted with a child and they have become grandparents. Hence to observe the tradition.

(8)

फागुन रो मइनो हो रसिया
होली आईगी रे हो रसिया
गउं वाटलो ***चना*** वाड़लो
करि लो खालो खेतर रे
होली आईगी रे
होली आईगी रे
अब ***गउं*** मसलो, ***चना*** मसलो
भर लो अपना भण्डार रे
होली आईगी रे
फागुन रो मइनो हो रसिया
होली आईगी रे
ढोल लइलो, थाली लइलो
चालो जइये भगोरिया मालवा रे
होली आईगी रे
तीर लइलो, तलवार लइलो
खेलो होली आज रे
होली आईगी रे
फागुन रो मइनो हो रसिया.....

'**Phagun ro maino…'**This song paints the eagerness to rush at the bhagoria fair and bathe in the holi colours. As to enjoy fully the beauty of the festivals there is a suggestion to harvesting and winnowing to grains (*Triticum aestivum* L., Poaceae, 'Genhu') and Grams (*Cicer arietinum* L., Fabaceae, 'Chana').

(9)

सई ***जामुन*** सई छाईये हाटडो पडाई दउँ।
सई ***जामुन*** सई हवगढ़ उहरी बूलाई दउँ।

सई ***जामुन*** सई हल्लाणा ने सनारया बुलाई दउँ।
सई ***जामुन*** सई हरवन ने रंगारा बुलाई दउँ।

सई ***जामुन*** सई रतलाम ने हलवाई बुलाई दउँ।
सई ***जामुन*** सई बाजणे ने भरावा बुलाई दउँ।

सई ***जामुन*** सई व वले वले दुकान्या बठाड़ी दउँ।
सई ***जामुन*** सई दुरे गथी बेवाणी बुलाई दउँ।

'Sai jamun (*Syzygium cumini* (L.) Skeels, Myrtaceae) **sai chayie…**'Bhils sing this song wherein it is explained that bounteous canopy of *Syzygium cumini* (Jambu) offer shade for Haats.

(10)

सिकसा वगर नीरेवाए नी रे ढोला मारूजी
हूं ते थाई जाबनयां पण सिकसा लेबा जावुं रे

सिकसा वगर नी परणुं रे नी रे ढोला मारूजी
सिकसा वगर जीव कलपे जीव ढोला मारूजी

सिकसा होएत दुनियाँ जीत लुँ दनिया ढोला मारूजी
सिकसा वगर ढोलण वाजुँ ढोलण ढोला मारूजी

सिकसा होएत अपसर बणूं, अपसर ढोला मारूजी
सिकसा केवाए आजनी दिवलया नी हेंग रे

सिकसा केवाए बापड़ी पुनमयो साँद रे
सिकसा केवाए आज नी परबातुं नो दन रे

सिकसा केवाए आपणी वाहलिया नी धार रे
सिकसा केवाए आज नी रूप नों रे दर्पण

सिकसा केवाए आज नी हुकेला वाड़ा मां हिसंण
सिकसा केवाए आज नी जीवडा नी जेड़

सिकसा केवाए आज नी रोहानो मारण ने
सिकसा केवाए आज नी वेलूं माँ नी आव रे

सिकसा केवाए तपण मां ***वडलियां*** नी सायां रे
वाट ना वटारू वले वावड़ली ना नीरूं रे

सिकसा टाली जीवड़लो किकम करी नकले रे
बापा गाम ने हिमाडे इसकूल भणवा जावा दे
मारो जीबड़ी समकहेरूपमया साँद जोग।

'**Siksa vager ni revay…'**This song paints learning as deep and shady as that of a banyan [Vadliya (*Ficus benghalensis* L., Moraceae)] tree.

(11)

तारो माटी रामस्यो, धवल्या धुरी मंगाड्या
खांडया मेडया क्यों लायो रे।।
बयल्या छोड़-बयल्या छोड़ देडया बयल्या छोड़।।
तारो माटी रामस्यो, धाडल *चोखा* मंगाड्या
टेमरया क्यों लायो रे ।।
तारो माटी रामस्यो, सकर मंगाड़ी
गूले क्यों लायो रे।।
तारो माटी रामस्यो, धवल्या घींव मंगाड्यो
तेले क्यों लायो रे।।
तारो माटी रामस्यो, ***चना*** नी दाल मंगाड़ी
चावल नी दाल, क्यों लायो रे।।

'Taro mati ramasyo…'In this song the tribal wives through the jungle fruits timru (*Diospyros melanoxylon* Roxb., Ebenaceae, 'Timru'), rice (*Oryza sativa* L., Poaceae, 'Chokha') and grams (*Cicer arietinum* L., Fabaceae, 'Chana') in a festive mood playfully dig at their in-laws.

Songs associated with the events of marriage also include several plants. References to *Curcuma longa* L. (Zingiberaceae, 'Haldi'), *Cicer arietinum* L. (Fabaceae, 'Channa', 'Bhungna'), *Mucuna pruriens* (L.) DC. (Fabaceae, 'Kevach'), *Butea monosperma* (Lam.) Taub. (Fabaceae, 'Khankhra'), *Oryza sativa* L. (Poaceae, 'Chokha', 'Chawal', 'Dhan') etc. are available in some folk songs:

(12)

हड़दी ले रे लोड़ेला पीड़ो ने पांजरो जणाय।
कवद लेले गांसेडी काड़ी-काड़ी जाणाय है।

लाडू लेरे लाड़ेला लाड़मने लाड़ला बोले है।
लाडू लेरे लाड़ेला लाड़ मने लाड़मा बोले है।

भुंगड़ा लेरे लाड़ेली भड़-भड़ बोली बोले रे।
भुंगड़ा लेरे लाड़ेली भड़-भड़ बोली बोले रे।

भजिया लेरे लाड़ेला भज-भज बोली बोले रे।
पपोड़ लेरे लाड़ेली पड़-पड़ बोली बोले रे।

(13)

भाई ने अतरी परजा आवि, आपणि बनो ना भाग में।
भाई ने बाज खुटी जारे, *खाक*रे जाणू पड़से।।

भाई रे पूरी पाड़ी लेजो।
भाई रे पाणी खुटी जासे, समुदर जाणु पड़से।

भाई रे पूरी पाणी भेजो।
भाई रे धान खुटी जासे, मालवे जाणु पड़से।

भाई रे पूरी पाड़ी भेजो।
भाई रे गुल खुटी जासे, मालवे जाणु पड़से।
भाई रे पूरी पाड़ि लेजो।

(14)

मारो कवनड़ा घर, ढेड्या ढासे झुणी।
मारो कवनड़ा घर, ढेड्या ढासे झुणी।।

कवच आजड़ झाजड़ करे ढेड्या कासे झुणी।
कवच आजड़ झाजड़ करे ढेड्या कासे झुणी।।

पुरयो चुली मेकणं आयो, पुरयो थड़-थड़ कापे वो।
पुरयो चुली मेकणं आयो, पुरयो थड़-थड़ कापे वो।

Besides this, majority of folk songs of tribals have reference of many plants in the body of song *i.e. Calotropis gigantea* (L.) Ait. f. (Asclepiadaceae, 'Ankdu'), *Cannabis sativa* L. (Cannabinaceae, 'Ganjo'), *Cocos nucifera* L. (Arecaceae, 'Narel'), *Cuscuta reflexa* Roxb. (Convolvulaceae, 'Amervel'), *Gossypium herbaceum* L. (Malvaceae, 'Kapas'), *Lawsonia inermis* L. (Lythraceae, 'Mendi'), *Musa paradisiaca* L. (Musaceae, 'Kero'), *Phoenix sylvestris* L. (Arecaceae, 'Khajor'), *Tectona grandis* L. f. (Verbenaceae, 'Sagad'), *Terminalia arjuna* (Roxb.) Wt. & Arn. (Combretaceae, 'Kavdo'), *Ziziphus mauritiana* Lam. (Rhamnaceae, 'Bor') etc.

Results and discussion

In this paper, 26 different plant species belonging to 26 genera and 22 families are found integrated with different folk songs. Most of the plant species included in folk songs belongs to family Fabaceae (3 species). The advantage of the present study on folk songs provides valuable data on: (1) new vernacular names of plant associated with various customs, beliefs, festivals and rituals; (2) traditional conservation strategies of natural resources; (3) knowledge of the indigenous flora of the region; (4) taboo and totem faith attached with the plants helps in conservation of local biodiversity; (5) understanding the relationship of different human societies with plant resources; (6) Still more plant species may be linked with folk songs in other districts. These studies

are in order. Similar investigation will reveal association of elements of biodiversity with folk songs. It should be undertaken as it informs on phytogeography and socio-economic aspects, besides cultural aspect; (7) Folk songs of a region is thus indicative of local Floristic diversity; and (8) folk songs thus reflects phytogeographical distribution of plants, agricultural and economic significance of an area, besides religious aspect of the local people.

Conflict of interest: The author has no conflict of interest.

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Ethnomedicine for filariasis used by the tribes of Khammam district, Andhra Pradesh

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Abstract

The paper deals with 25 species of plants covering 24 genera and 16 families used by the tribes of Khammam district, Andhra Pradesh, for curing filariasis. Fabaceae is the dominant family with seven species followed by others. Herbs are represented with 10 species. Whole plant, stem bark and leaves with five species each are used to the maximum extent. In combination treatments a maximum of nine plants are involved. *Capparis brevispina* and 15 practices were found to be new.

Key Words: Filariasis, Elephantiasis, Microfilariae, Mass Drug Administration

Introduction

Nematode *Wuchereria bancrofti* is the causative agent of lymphatic filariasis. This disease is transferred by *Culex* mosquitoes and is found mainly in the tropics and subtropics. They infect the lymphatic system and block the flow of lymph that leads to the swelling of limbs. As it causes swelling in legs, it is also called elephantiasis. Adult worms nest in the lymphatic vessels and disrupt the normal function of the lymphatic system. The worms can live for approximately 6–8 years and, during their lifetime, produce millions of microfilariae (immature larvae) that circulate in the blood. Mosquitoes are infected with microfilariae (mF) by ingesting blood when biting an infected host. Microfilariae mature into infective larvae within the mosquito. When infected mosquitoes bite people, mature parasite larvae are deposited on the skin, from where they can enter the body. The larvae then migrate to the lymphatic vessels where they develop into adult worms, thus continuing a cycle of transmission. Lymphatic filariasis is transmitted by different types of mosquitoes, for example by the *Culex* mosquito, widespread across urban and semi-urban areas, *Anopheles*, mainly found in rural areas, and *Aedes*, mainly in endemic islands in the Pacific.

Lymphatic filariasis infection involves asymptomatic, acute and chronic conditions. The majority of infections are asymptomatic, showing no external signs of infection while contributing the transmission of the parasite. These asymptomatic infections still cause damage to the lymphatic system and the kidneys and alter the body's immune system (WHO 2013).

Lymphatic filariasis affects over 120 million people in 72 countries throughout the tropics and sub-tropics of Asia, Africa, the Western Pacific, and parts of the Caribbean and South America. About 31 million people are estimated to be the carriers of mF and over 23 million suffer from filarial disease manifestations in India. The state of Bihar has highest incidence of the disease (over 17%) followed by Kerala (15.7%) and Uttar Pradesh (14.6%). Andhra Pradesh and Tamil Nadu have about 10% incidence (Agrawal & Sashindran 2006).

The Khammam district extends over an area of 16, 029 sq km with a total forest area of 7, 594.38 sq. km. It is surrounded by Chhattisgarh and Odisha states in the North, Krishna district in the South, East and West Godavari districts in the East and Nalgonda and Warangal districts in the West. The district extends from 16^0 45' and 18^0 35' N latitude and 79^0 47' to 81^0 47' E longitude (Fig.1). Khammam district with 26.47% tribal population stands first in Andhra Pradesh (Census 2011) housing Koya, Lambada, Gond/Naikpod, Yerukula, Nayak and Konda Reddi tribal

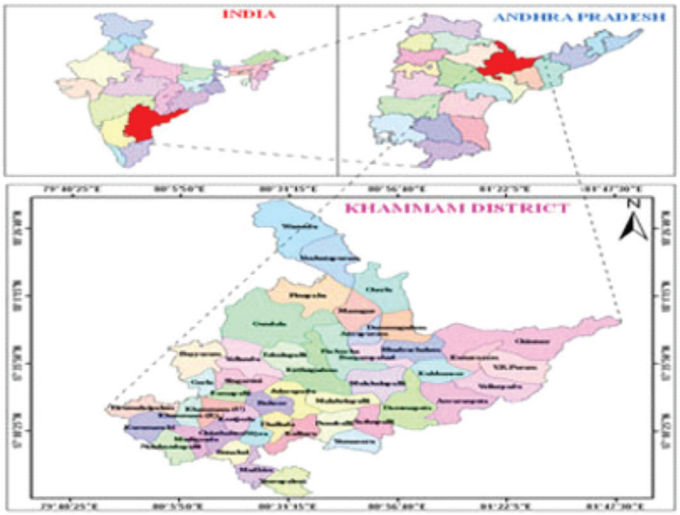

Fig. 1: Map of study area (Khammam district)

communities. As of September 2021 data, there were 3085 active filariasis cases but a specific percentage of the total population was not clearly defined in the available reports.

Though there are publications on ethnomedicine dealing with a variety of diseases *viz.*, asthma, cold and cough, cuts and wounds, diabetes, dysentery and diarrhea, eye problems, fever, hemorrhoids, kidney stones, menstrual disorders, rheumatism, sexually transmitted diseases, skin diseases, tumors, and urinary complaints (Upadhyay & Chauhan 2000; Raju & Reddy 2005; Manjula *et al.* 2013 a,b,c,d,e,f; 2014a, b; 2015; Manjula & Reddi 2015; 2016; 2017a,b; 2020; Priyadarshini & Ragan 2019) not much information is available on filariasis necessitating the present study.

Materials and Methods

Ethnobotanical survey was conducted in tribal rich habitations of Khammam district once in every two months from 2008 to 2012 with a duration of 10-15 days. About 4-7 days were spent during each trip with different tribal communities in their dwellings. After establishing good rapport with them, the utility of plants and detailed methods of uses were documented. In 102 pockets of the study area (Table 1), 102 *vaidhyas* and practitioners were consulted. Data collected were cross checked with the data obtained from same as well as from different settlements on different occasions for authenticity. Voucher specimens were collected in both flowering and fruiting stages, and herbarium specimens were deposited in the herbarium of the Department of Botany, Andhra University, Visakhapatnam (AUV), after identification with the help of '*Flora of the Presidency of Madras'* (Gamble 1915-1935). Currently accepted botanical names were retrieved by using Plants of the World Online web site (powo.science.kew.org).

Table 1: Localities covered in Khammam district for the present study

S.No.	Locality	S.No.	Locality	S.No.	Locality	S.No.	Locality
1	Peruru	2	Chikupalli	3	Gummadi doddi	4	Soraveedu
5	Chiruthapalli	6	Thaliperu	7	Yerrampadu	8	Vissapuram
9	Edugurallapalli	10	Thulisipaka	11	Mothugudem	12	Marrigudem
13	Tekulaboru	14	Gowridevipeta	15	Rekapalli	16	Sriramagiri
17	Jeedikuppa	18	Mettegudem	19	Thondipaka	20	Rudrammakota
21	Koyida	22	Bhudevipeta	23	Maravarigudem	24	Diginepalli
25	Sambayigudem	26	Karakagudem	27	Parnasala	28	Chinnanallaballi
29	Pedanallaballi	30	Mandikunta	31	Kaggaram	32	Kinnerasani
33	Jagannadhapuram	34	Singabhupalem	35	Nimmagadda	36	Koyagudem
37	Bodu	38	Sulanagar	39	Mamidigudem	40	Mukundapuram
41	Kanchanapalli	42	Allapalli	43	Erusulapuram	44	Kothapeta
45	Venkatapuram	46	Manikyapuram	47	Perupalli	48	Patvarigudem
49	Balarajugudem	50	Nagupalli	51	Sambaigudem	52	Gondigudem
53	Chaparallapalli	54	Mukamamidi	55	Madaram	56	Subbledu
57	Birolu	58	Paleru	59	Kesavapuram	60	Lankapalli
61	Mandalapadu	62	Buvannapalem	63	Chandrapatla	64	Kappalabandam
65	Annarigudem	66	Narayanapuram	67	Marlapadu	68	Kandukuru
69	Kunchaparthi	70	Seripuram	71	Jannaram	72	Thimmaraopeta
73	Ramakrishnapuram	74	Pallipadu	75	Chinnamunagala	76	Pathalingala

S.No.	Locality	S.No.	Locality	S.No.	Locality	S.No.	Locality
77	Govindarala	78	Maddivarigudem	79	Muttagudem	80	Ayyanapalem
81	Thungaram	82	Sarapaka	83	Eravendi	84	Guvvagudem
85	Gokinepalli	86	Rajeswarapuram	87	Mangapuram	88	Birannagudem
89	Pallipadu	90	Rabbavaram	91	Ravinuthala	92	Govindapuram
93	Madupalli	94	Mamuluru	95	Nagupalli	96	Lankapalli
97	Kistapuram	98	Bethalapadu	99	Ragallathanda	100	Yerrupalem
101	Thallada	102	Kusumanchi				

Enumeration

The plants are enumerated alphabetically with their botanical name followed by family, vernacular name, English name, locality, collector and voucher number. Each ethno-medicinal practice is provided with the part(s) used, method of preparation, mode of administration and dosage along with the practising tribe in parenthesis. Plants and practices marked with an asterisk (*) are considered to be new or less known.

Amorphophallus paeoniifolius (Dennst.) Nicolson, Araceae, 'Siri kanda', Elephant foot yam, Chintur, RRM 10033.
*****Tuber paste mixed with cow ghee is applied on the affected areas till cure (Koya).

Andrographis paniculata (Burm. f.) Nees, Acanthaceae, 'Chedhukoora', King of bitters, Nagupalli, RRM 10110.
Leaves with those of *Senna occidentalis* (L.) Link are taken in equal quantities and ground. Two spoonful of paste mixed with a glass of cow milk is administered twice daily for 21 days (Nayak).

Brassica nigra (L.) Koch, Brassicaceae, 'Varnavalu', Tree mustard, Yerrampadu, RRM 10115.
*****One spoonful of oil mixed with equal quantity of betel leaf juice is administered once a day (Lambada).

Calotropis gigantea (L.) W.T. Aiton, Asclepiadaceae, 'Nalla jilledu', Gigantic swallow wort, Gowridevipeta, RRM 10076.
Handful of seeds ground with five seeds of *Piper nigrum* L. and half spoon of honey. Two spoonful of paste is administered twice daily for 21 days. Meanwhile the above paste is applied on the affected areas once a day for 21 days (Nayak).

Calotropis procera (Aiton) W.T. Aiton, Asclepiadaceae, 'Tella jilledu', Swallow-wort. Maddivarigudem, RRM 10118.
Root paste is applied on the affected parts (Konda Reddi).

****Capparis brevispina*** DC., Capparaceae, 'Adavi uppi', Indian caper, Chiruthapalli, RRM 10180.
Whole plant juice is applied twice a day on the affected parts for 30 days (Gond).

Carica papaya L., Caricaceae, 'Boppayi', Papaya, Thimmaraopeta, RRM 10079.
Leaf juice mixed with sesame oil is applied on the affected areas once a day till cure (Yerukula).

Clitoria ternatea L., Fabaceae, 'Sanku Pushpalu', Butter fly pea, Mettugudem, RRM 10189.
*****Root paste applied externally on affected parts (Koya).

Cullen corylifolium (L.) Medik., Fabaceae, 'Bapuna', Babchi, Enkuru, RRM 10509.
*****Plant poultice applied externally for relief from pain (Koya).

Cyanthillium cinereum (L.) H. Rob., Asteraceae, 'Garitakammi', Ash colored fleabane, Paleru, RRM 10523.
Leaf juice is boiled in sesame oil and applied externally on the affected parts once a day for three weeks to cure pain and inflammation (Konda Reddi).

Cyperus pangorei Rottb., Cyperaceae, 'Mrusta', Mat sedge, Vissapuram, RRM 10356.
Rhizomes are ground with roots of *Hemidesmus indicus* (L.) R.Br. and stem bark of *Holarrhena pubescens* Wall. ex G.Don and the extract is given in two spoonful doses twice a day for three weeks (Konda Reddi).

Eclipta prostrata (L.) L., Asteraceae, 'Guntagalagara', Trailing eclipta, Kistapuram, RRM 10227.
Whole plant ground into paste and mixed with coconut oil is applied on the affected areas (Lambada).

Gmelina arborea Roxb. ex Sm., Verbenaceae, 'Burugu teku', Candahar tree, Vissapuram, RRM 10255.
*****Fifty ml of stem bark decoction is administered once a day till cure (Nayak).

Guazuma ulmifolia Lam., Sterculiaceae, 'Rudraksha', Musket tree, Birannagudem, RRM 10287.
*Two spoonful of stem bark paste mixed in 200 ml of cow milk is administered twice a day for ten days (Gond).

Hybanthus enneaspermus (L.) F. Muell., Violaceae, 'Ratna Purusha', Spade flower, Peruru, RRM 10279.
*****Whole plant paste is applied on the affected parts (Yerukula).

Madhuca longifolia (L.) J.F. Macbr., Sapotaceae, 'Ippa', South Indian mahua, Bayyaram, RRM 10208.
*****Stem bark paste is plastered on the affected areas to reduce burning sensation (Koya).

Mimosa pudica L., Fabaceae, 'Lajjukudi', Touch-me-not, Peruru, RRM 10267.
Leaf paste is applied on the infected leg to get relief from pain and inflammation (Lambada).

Mucuna pruriens (L.) DC., Fabaceae, 'Dula dama', Cowitch, Chikupalli, RRM 10306.
*Root paste is applied on the affected areas till healing (Nayak).

Piper longum L., Piperaceae, 'Pippallu', Long pepper, Chiruthapalli, RRM 10402.
*Roots with seeds of *Datura metel* L. are taken in equal quantities and ground. Two spoonful of this paste mixed in a glass of cooled water is administered once a day till cure (Yerukula).

Pongamia pinnata (L.) Pierre, Fabaceae, 'Ganuga', Indian beech tree, Ramakrishnapuram, RRM 10413.
*****One spoonful of leaf juice mixed with 10 ml of mustard oil is administered orally (Yerukula).

Ricinus communis L., Euphorbiaceae, 'Amudamu', Castor oil, Vissapuram, RRM 10492.
*Seeds (10 g) with those of *Piper nigrum* L. (5 g) are taken and ground. Two spoonful of paste is administered twice daily for 15 days (Lambada).

Senna occidentalis (L.) Link, Fabaceae, 'Kasinda', Coffee senna, Kandukuru, RRM 10019.
Root bark paste (2 g) with ghee is taken in five ml dose twice a day to reduce inflammation due to filariasis (Gond).

Tectona grandis L.f., Verbenaceae, 'Teku', Teak, Thaliperu, RRM 10438.
*****Two spoonful of stem bark decoction is administered once daily till cure (Konda Reddi).

Vachellia nilotica (L.) P.J.H. Hurter & Mabb., Fabaceae, 'Nalla thumma', Black babool, Bethampudi, RRM 10002.
*Stem bark with those of *Senna occidentalis* (L.) Link, *Cassia fistula* L., *Azadirachta indica* A. Juss., *Tamarindus indica* L., *Pongamia pinnata* (L.) Pierre, *Phyllanthus emblica* L., *Ziziphus oenoplia* (L.) Mill., tuberous roots of *Curculigo orchioides* Gaertn. and fruit of *Musa paradisiaca* L. are taken in equal quantities and fermented in water for a week. 100 ml of ferment is administered twice a day for one month (Konda Reddi).

Vanda tessellata (Roxb.) Hook. ex G. Don, Orchidaceae, 'Vajanika', Ichneumon plant, Vajedu, RRM 10516.
*****Whole plant paste is applied on the affected areas (Koya).

Results and Discussion

The paper deals with 25 species of plants covering 24 genera and 16 families used by the tribes of Khammam district, Andhra Pradesh, for curing filariasis. Family-wise, habit-wise and morphological analysis data are presented in Figs. 2-4. Habit-wise analysis showed the dominance of herbs with 10 species followed by trees (seven spp.), shrubs (five spp.), climbers (two spp.) and a lone epiphyte (Fig. 2). Fabaceae is the dominant family with four species followed by Mimosaceae, Asteraceae, Asclepiadaceae, Verbenaceae (two spp. each) and others with one species each (Fig. 3).

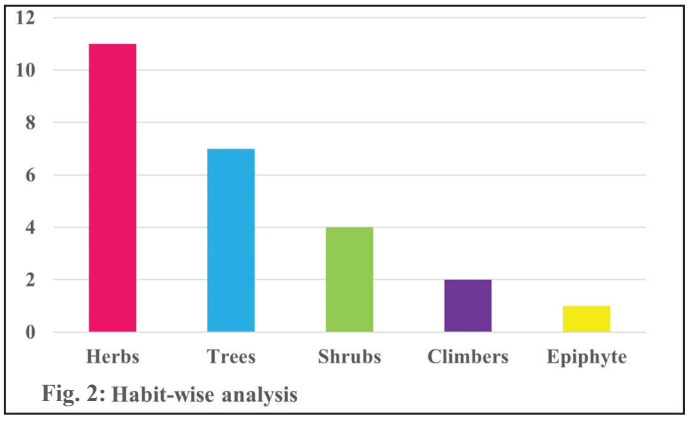

Fig. 2: Habit-wise analysis

Morphological analysis showed the maximum utilization of whole plant, stem bark and leaves in five practices each followed by root (four), seed (two), tuber, rhizome, root bark, and oil in one practice each (Fig. 4). The crude drugs are administered either in the form of paste, powder, juice, decoction, poultice with water, cow milk, cow ghee, coconut oil, or mustard oil. Of the 25 practices, 18 involved single plant, 5 with two plants, one each with three and nine plants. *Capparis brevispina* and 15 practices were found to be new or less known (Jain 1991; Kirtikar & Basu 2003; Jain & Jain 2016).

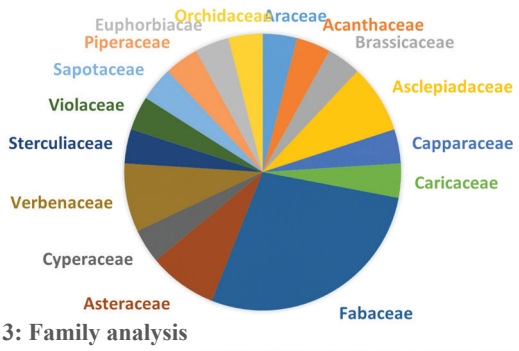

Fig. 3: Family analysis

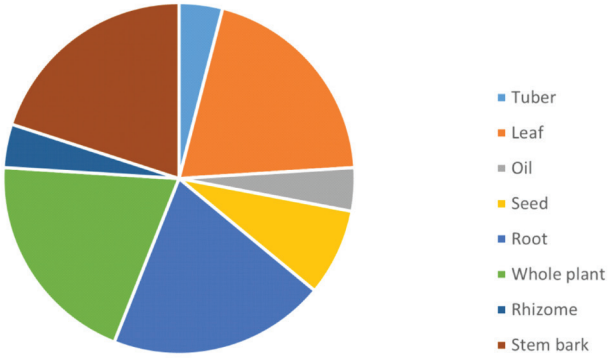

Fig. 4: Morphological analysis

Table 2: Plants used for similar purpose in different parts of India, Bangladesh and Nigeria

S. No.	Plant species	Tribe/Area/Region/Country	References
1.	*Calotropis gigantea*	Chenchu, Yerukala tribes of Krishna district, Andhra Pradesh People of Thanjavur district, Tamil Nadu Korku, Gond, Nihal tribes of East Nimar of Madhya Pradesh	Venkanna (1990) Jayakumar (2015) Mishra (2017)
2.	*Calotropis gigantea, Cyanthillium cinereum, Mimosa pudica, Senna occidentalis*	Yanadi, Nakkala, Irula, Yerukala, Sugali tribes of Chittoor, Andhra Pradesh	Vedavathy *et al.* (1997)
3.	*Calotropis procera*	Sahanra, Binjhal, Kondh, Gond tribes of Bargarh district, Odisha	Sen & Behera (2007)
4.	*Cyanthillium cinereum*	Folklore of ten southern and one northern districts of Karnataka People of Guntur district, Andhra Pradesh Tribes of Odisha	Shiddamallayya *et al.* (2010) Babu & Ammani (2010) Panda & Luyten (2018)
5.	*Andrographis paniculata, Calotropis gigantea, Calotropis procera*	People of India	Murthy *et al.* (2011)
6.	*Eclipta prostrata*	Chenchu tribes of Nallamalais, Andhra Pradesh Rural people of Kanyakumari district, Tamil Nadu	Rao & Sunitha (2011) Sukumaran *et al.* (2018)
7.	*Mimosa pudica*	Practitioners of Bangladesh	Rahman *et al.* (2013)
8.	*Carica papaya*	People of Nigeria	Olayemi *et al.* (2013)
9.	*Calotropis procera, Eclipta prostrata*	People of Uttarakhand	Balakrishna *et al.* (2019)

Elimination of lymphatic filariasis is possible by stopping the spread of the infection through preventive chemotherapy. The WHO-recommended preventive chemotherapy strategy for lymphatic filariasis elimination is Mass Drug Administration (MDA). MDA involves administering an annual dose of medicines to the entire at-risk population. The medicines used have a limited effect on adult parasites but effectively reduce the density of microfilariae in the bloodstream and prevent the spread of parasites to mosquitoes (WHO 2013).

Conclusion

The main objective of the present study was to document the medicinal plants used for curing filariasis in Khammam district of Andhra Pradesh. Our results reveal that the outcome of this study shows that herbaceous plants of medicinal value are mainly used for curing this ailment.. The uncontrolled collection of plants and overgrazing in the area is dangerous for future generations due to loss of indigenous flora. The tribal communities of the area have

maintained a high amount of indigenous knowledge. It is revealed that though the area is a rich source for important medicinal herbs, but there were no conservation measures and strategies to protect these plant wealth have been initiated. Programs to foster awareness and understanding of plant management among the people are urgently needed. These measures will ensure protection of the available plant diversity.

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सरहुल की परंपरा, इतिहास एवं इसमें प्रयुक्त पौधों के औषधीय गुण

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सरहुल/बाहा/बसंत ऋतु में मनाए जाने वाला आदिवासियों का प्रमुख त्यौहार है। बसंत ऋतु में पेड़ जब पतझड़ में अपनी पुरानी पत्तियों को हटाकर टहनियों पर नई-नई पत्तियाँ लाने लगती हैं, तब सरहुल का पर्व मनाया जाता है। मुख्यतः यह पर्व चैत्र मास के शुक्ल पक्ष के तृतीय दिन से शुरू होता है और चैत्र की पूर्णिमा पर समाप्त हो जाता है। यह पर्व अंग्रेजी माह के अनुसार अप्रैल में मुख्य रूप से मनाया जाता है। कभी-कभी यह पर्व मार्च के अंतिम सप्ताह में भी आता है। यह पर्व झारखंड, उड़ीसा, बंगाल और मध्य भारत के आदिवासी क्षेत्रों में मनाया जाता है।

इस पर्व में 'साल' अर्थात् 'सखुआ' (*शोरिया रोबस्टा; Shorea robusta*) के वृक्ष का विशेष महत्व है। आदिवासियों की परंपरा के अनुसार इस पर्व के बाद ही नई फसल (रबि) विशेषकर गेहूं की कटाई आरंभ की जाती है। इसी पर्व के साथ आदिवासियों का 'नव वर्ष' शुरू होता है ।

पौराणिक कथा के अनुसार जब महाभारत का युद्ध चल रहा था, तब आदिवासियों ने युद्ध में कौरवों का साथ दिया था। जिस कारण कई मुंडा सरदार पांडवों के हाथों मारे गए थे। इसलिए उनके शवों को पहचानने के लिए उनके शरीर को साल के वृक्षों के पत्तों और शाखाओं से ढका गया था। इस युद्ध में ऐसा देखा गया कि जिन शवों को साल के पत्तों से ढका गया था वे शव सड़ने से बच गए थे और ठीक थे। पर जो दूसरे पत्तों या अन्य चीजों से ढ़के गए थे वे शव सड़ गए थे। ऐसा माना जाता है कि इसके बाद आदिवासियों का विश्वास साल के पेड़ों और पत्तों पर बढ़ गया।

ऐसी मान्यता है सरहुल के दिन सृष्टि के दो महान स्वरूप शक्तिमान सूर्य एवं कन्या रूपी धरती का विवाह होता है। जिसको कुँड़ुख़ या उरांव में ख़ेख़ेल बेंजा कहते हैं। इसका प्रतिनिधित्व क्रमशः उरांव पुरोहित पहान (नयगस) एवं उसकी धर्मपत्नी (नगयिनी) करते हैं। इनका स्वांग प्रतिवर्ष रचा जाता है। उरांव संस्कृति में सरहुल पूजा के पहले तक धरती कुंवारी कन्या की भांति देखी जाती है। धरती से उत्पन्न नए फल-फूलों का सेवन वर्जित हैं। इस नियम का कठोरता से पालन किया जाता है।

पहान, घड़े का पानी देखकर बारिश की भविष्यवाणी करते हैं। पहान, सरना स्थल पर पूजा संपन्न करता है और तीन मुर्गों की बलि दी जाती है और खिचड़ी बनाकर प्रसाद के रूप में खाते हैं। फिर पहान प्रत्येक घर के बुजुर्ग या गृहिणी को चावल एवं सरना फूल देते हैं, ताकि किसी प्रकार का संकट घर में न आए। शाम के वक्त और दूसरे दिन सुबह फूल खोंसी की जाती है। गांव का पाहन एक सूप में पूजा किए गए सरई (सखुआ) फूल के गुच्छे को लेकर घर-घर में घूमता है और हर घरों के कोने में फूल खोंसी की जाती है। इसके साथ-साथ परिवार के हर सदस्य को भी फूल दिया जाता है। पाहन महिलाओं के माथे के खोंपा में फुल खोंसता है। पुरूषों के कान में सरई फूल (*शोरिया रोबस्टा*) का गुच्छ लगाया जाता है।

सरहुल के एक दिन पहले केकड़ा खोदने का रिवाज है। केकड़े को पूर्वजों के रूप में बाहर लाकर सूर्य और धरती के विवाह का साक्षी बनाया जाता है। पुजारी जिसे पाहन के नाम से पुकारते हैं, उपवास रख केकड़ा पकड़ता है। इसके लिए 'कुटना अड़ा' (*Sphaeranthes indicus*) के सूखे पौधे का चूर्ण केकड़े के बिल में डालते हैं जिसकी गंध से केकड़े बाहर आ जाते हैं (Kumari & Kumar 2015) केकड़े को पूजा घर में अरवा धागा से बांधकर टांग दिया जाता है। जब धान की बुआई की जाती है तब इसका चूर्ण बनाकर गोबर में मिलाकर धान के साथ बोआ जाता है। ऐसी मान्यता है कि जिस तरह केकड़े के असंख्य बच्चे होते हैं, उसी तरह धान की बालियां भी असंख्य होगी। इसीलिए सरहुल पूजा में केकड़े का भी विशेष महत्व है। सरहुल के बाद ही खरीफ फसल की बोआई के लिए खाद और बीज डाला जाता है।

रांची (झारखण्ड) में आदिवासी समुदायों द्वारा सरहुल पर्व मनाने की कुछ झलकियां

सरहुल के दूसरे दिन यानी सरहुल बासी के दिन भी लोग एक दूसरे के घरों में जाते हैं और अच्छे पकवान अतिथियों को खिलाते हैं। इसमें चावल की रोटी, बेग साग की सब्जी, बेंग साग की चटनी, मड़वा का डुम्बू, करहनी चावल की बनी हुई 'हड़िया' (देसी पेय) मेहमानों को परोसा जाता है। गांव जंगलों में पाले गए मुर्गा, खस्सी, बत्तख आदि लकड़ी की आग में पकाएं जाते हैं।

ऐसी मान्यता है कि आदिवासियों का नृत्य ही संस्कृति है। इस पर्व में झारखंड और अन्य राज्यों में जहाँ यह पर्व मनाया जाता है जगह-जगह नृत्य किया जाता है। महिलाएँ सफेद में लाल पाड़ वाली साड़ी पहनती हैं और नृत्य करती हैं। सफेद पवित्रता और शालीनता का प्रतीक है। जबकि लाल संघर्ष का। सफेद सिंगबोंगा तथा लाल बुरूबोंगा का प्रतीक माना जाता है इसलिए सरना झंडा में सफेद और लाल रंग होता है। इस अवसर पर जो गीत अत्यंत ही लोकप्रिय है गाया जाता है। उस कुँड़ुख़ गीत की दो पंक्ति इस प्रकार है:-

एंदेर पूंपेन मेझेरकी पेल्लो
कौन का फूल अपने जूड़े में लगाई हो
भगजोगनी लेखा लवकारदी
भगजोगनी जैसे दमक चमक रही हो

Ethno-medicinal properties of plants used during Sarhul Festival

Shorea robusta C.F. Gaertn. (*शोरिया रोबस्टा*)

'सखुआ' के पेड़ के सभी भाग अर्थात पंचांग औषधीय उपयोग में लाए जाते हैं। सखुआ के छाल का उपयोग पेट की शिकायत होने, दस्त लगातार होने पर किया जाता है। इसके छाल को पीस कर इसका पानी सेवन करने से दस्त बंद हो जाता है (Wani *et al.* 2012)। दांतों और मसूड़ों की सुरक्षा के लिए सखुआ के दातून से दांतों की सफाई की जाती है। इससे दांत सफेद और सुंदर होते हैं। मसूड़े मजबूत होते हैं। इसके काढ़े से धोने से घाव ठीक हो जाता है (Kaur *et al.* 2001)।

सखुआ के पत्ते का संग्रहण कर आदिवासी और मूलवासी महिलाएँ दोना और पत्तल की थाली बनाकर बाजार में बेचती है। शादी विवाह और बड़े कार्यक्रमों में सखुआ के बने पत्तल और दोना में ही लकड़ी का पका भोजन परोसा जाता है। इसे पवित्र माना जाता है।

***Centella asiatica* (L.) Urb.** (*सेंटेल्ला एशियाटिका*)

पौधे का पेस्ट पेट की बीमारी, चर्म रोग, फाईलेरिया, किडनी की बीमारी, दमा, ल्युकोरिया आदि में प्रयुक्त होता है।

पौधे के काढ़े का प्रयोग ब्रेन.टोनिक के रूप में किया जाता है (Samuel *et al.* 1922)। पौधे में यह गुण मेडिकासोसाईड, मेडेकैसिक एसिड, एसीटीकोसाइड और पेन्टासाईक्लिक ट्राइटरपिन के कारण होता है (Gohil *et al.* 2010)।

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History and traditions of 'Sarhul' festival, associated medicinal plants and their properties

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Abstract

'Sarhul' festival is celebrated by various tribal communities in Jharkhand, Odisha, West Bengal and Central India during the spring season. *Shorea robusta* ('Sakhua') has been deeply associated with this festival along with *Sphaeranthes indicus*, and *Centella asiatica*. The brief history and rituals practised in this festival are also discussed in this article.

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SEB Medal Award Function and the General Body Meeting of SEB

SEB Medal Award-2022 function and the General Body Meeting of the Society of Ethnobotanists (SEB) was organized on 14 February, 2025 at International symposium organized by Botanical Survey of India, Kolkata at National Library, Bhasha Bhawan, Alipore, Kolkata (WB) in afternoon session at Dhono Dhanyo Auditorium.

1. SEB Medal Award-2022 Function, plenary and invited lectures

The session was convened and chaired by Dr. Manjoosha Srivastava, Secretary SEB and co-chaired by Dr. Sanjeev K. Ojha, Member EB for conducting a special session of the Society of Ethnobotanists which included introduction and information about the society and the felicitation of SEB Medal Awardees-2022:

1. **J.W. Harshberger Medal**- Dr. A. A. Mao, President, SEB & Director, BSI, Kolkata
2. **E.K. Janaki Ammal Medal**- Dr. Ranee Prakash (UK)
3. **S.K. Jain Medal** - Dr. Prasanjit Mukherjee (Jharkhand)
4. **P. Sen Sarma Medal**- Dr. Mrs. Shubhangi Pawar (Maharashtra)

Remaining two medal awardees viz.: Dr. Dinesh Jadhav (MP) and Dr. K.J. Singh (UP) recipients of B.N. Mehrotra Medal and D.C. Pal Medal respectively did not attend the symposium. S.K. Jain Award for the best Ph.D. thesis in Ethnobotany, could not be awarded to any one, as no thesis was found suitable for this award. Medal awardees delivered plenary lectures and an invited talk on **Ayurveda Connects to Ethnobotany** by Dr. Sanjeev K. Ojha, Chief Scientist, CSIR-NBRI, Lucknow.

2. General Body Meeting of SEB

A General Body meeting of the Society of Ethnobotanists (SEB) was held and the following members were present in the GB meeting:

1. Dr. A. A. Mao (President)
2. Dr. Ranee Prakash (London, UK), (Vice President)
3. Dr. Manjoosha Srivastava (Secretary, Hq.)
4. Dr. Sunil K. Srivastava (Editor)
5. Dr. Sanjeev K. Ojha, Member, EB
6. Dr. Radha Krishnan, Member,EC
7. Dr. R.L.S. Sikarwar, Member,EC
8. Dr. Mangesh J. Dagawal, Member,EC
9. Dr. Mehtab Bukhari, (Secretary, Goa Chapter)
10. Prof. Ganga Prasad (Secretary, Kerala Chapter)
11. Dr. A.K. Sahoo (Member, EB)
12. Dr. Avinash Bharati (Member)
13. Dr. Sandeep Kumar Behra (Member)
14. Dr. V. Sundaresan (Member)
15. Dr. Prasanjit Mukherjee(Member)
16. Dr. Suchandra Dutta (Member)

A total 69 members participated in the GB meeting and signed the attendance register. Dr. A.K. Goel, Vice-President (Hq) SEB could not attend the meeting due to urgent unforeseen reasons.

Dr. A.A. Mao, President, SEB chaired the General Body Meeting and given the opening remarks. The meeting started with the welcome by Dr. Manjoosha Srivastava for Chair and the members as well as the delegates present in the GB meeting.

2.1. Approval for increasing the number of EC and EB members

Dr. Manjoosha Srivastava informed the house that currently, there are 9 members each in EC and EB, but to give the wider representation, we need to add more members to the EC and EB. Thus, she proposed before GB members to increase the number to 15 each for EC & EB. The proposal was accepted unanimously by all members present in GB meeting.

2.2. SEB EC & EB Elections - 2025

The names of the proposed nominations were read one by one before the members present in the GB meeting which were seconded and accepted unanimously with the voice


136th Foundation Day Celebration


136 वाँ स्थापना दिवस समारोह
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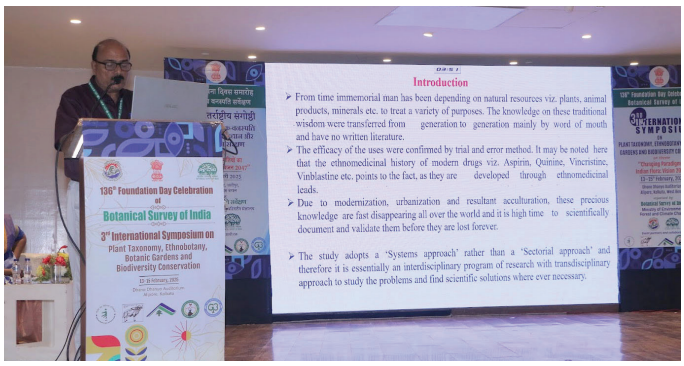
136th Foundation Day Celebration
Botanical Survey of India


136th Foundation Day Celebration



Photographic glimpses of SEB Medal Awards-2022 Function and General Body Meeting of Society of Ethnobotanists

vote by all the members. Dr. A. A. Mao proposed one woman an nominee (Dr. Suchandra Dutta) for EC which was confirmed by the members.

A. SEB Executive Council-2025

1. Dr. Ajit Kumar Shasany – President
2. Dr. Anil K. Goel – Vice President HQ
3. Dr. Veena Satya- Vice President
4. Dr. S.S. Dash- Vice President
5. Dr. Ranee Prakash - Vice President
6. Dr Manjoosha Srivastava - Secretary

7. Dr Ajit Pratap Singh - Joint Secretary
8. Dr. Vijay Vishnu Wagh- Treasurer
9. Dr. K.K. Rawat- Joint Treasurer

EC Members

1. Dr. A.A. Mao, Immediate Past President & Ex-Officio Member
2. Dr. Sanjeev K. Ojha
3. Dr. D.K. Upreti
4. Dr. Gaurav K. Mishra
5. Dr. Vinay Sahoo
6. Dr. Mangesh Dagawal
7. Dr. Arvind K. Saklani
8. Dr. A.K.S. Rawat
9. Dr. A.K. Sahoo
10. Prof. Ajit Das, Assam
11. Dr. K. Radhakrishnan
12. Dr. Virendra Nath
13. Dr. Avinash Kumar Bharti
14. Dr. Suchandra Dutta
15. Dr. Basavi Kiro

B. SEB Editorial Board - 2025:

1. Dr. Sunil K. Srivastava, Chief Editor
2. Dr. Vartika Jain, Editor
3. Dr. K.J. Singh, Managing Editor

Members

1. Dr. D.K. Singh
2. Dr. A.G. Pandurangan
3. Dr. Prabhu M. Kumar
4. Dr. Athar Ali Khan
5. Dr. Sandeep K. Behra
6. Prof. Ashok .K. Jain
7. Dr. V. Sampath Kumar
8. Dr. Bhaskar L. Punjani
9. Dr. Amia Ekka
10. Dr. N.K. Dhal
11. Dr. Pankaj A. Dhole
12. Dr. R.L.S. Sikerwar
13. Dr. K. Haridasan
14. Dr. Sunita Garg
15. Dr. L.B. Chaudhury

The meeting ended with the vote of thanks proposed by Dr. Manjoosha Srivastava, to the chair and all EC, EB and the members and delegates present in the meeting for their gracious presence and sparing valuable time for the fruitful deliberations.

3. SEB Medal Awardees for-2024

Applications of the following Life members were successful for SEB Medal Awards-2024:

1. **E.K. Janaki Ammal Medal:** Dr. Vartika Jain (Rajasthan)
2. **J.W. Harshberger Medal :** Prof. Abhaya Prasad Das (WB)
3. **S.K. Jain Medal:** Dr. Harish Chander Dutt (J&K)
4. **B.N. Mehrotra Medal:** Dr. Mangesh J. Dagawal (Maharashtra)
5. **D.C. Pal Medal:** No Award
6. **P. Sen Sarma Medal:** Dr. M. Navas (Kerala)
7. **S. K. Jain Award for 'Best Ph. D. thesis in Ethnobotany:** 1. Dr. Abhishek Dutta (J&K)
   2. Dr. Suawalal Dawar (MP)

Manjoosha Srivastava
Anil K. Goel
Sanjeev K. Ojha

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Report on Dr. S.K. Jain Memorial Lectures (25th March, 2025)

CSIR-National Botanical Research Institute and the Society of Ethnobotanists jointly organized a half-day event, viz.: **Dr. S.K. Jain Memorial Lectures on 25 March, 2025 in** the **Lotus Auditorium at KN Kaul Block, CSIR-NBRI,** Lucknow, to commemorate the memories of the Late Dr. S.K. Jain, founder President of the Society of Ethnobotanists and the father of Indian ethnobotany.

The program began with the Saraswati Vandana and the lighting of the lamp by the dignitaries at the Dias, followed by the floral tributes to the Late Dr. S.K. Jain. The welcome address was delivered by Dr. A.K. Shasany, Director, CSIR-NBRI and the President, Society of Ethnobotanists, Lucknow. Dr. Anil K. Goel, Vice President and Former Chief Scientist, CSIR-NBRI, briefed about the Dr. Jain and the Society of Ethnobotanists. Dr. S.K. Ojha, Chief Scientist, CSIR-NBRI, introduced the invited speakers: Dr. Ashok Kumar Jain and Dr. Arvind Kumar Saklani.

Dr. Ashok Kumar Jain, Former Prof., Jiwaji University, Gwalior delivered his invited lecture titled **"Ethnobotany: A Journey through the Ages"** in which he narrated the evolution of ethnobotany from the ancient times to the present period. Dr. Arvind Kumar Saklani, Vice President, Agribiotech, Sami-Sabinsa Group delivered the lecture on **"Ethnobotany and sustainable bio-entrepreneurship".** He emphasized about the significant role of ethnobotany from the drug development to the sustainable bio-entrepreneurship.

The dignitaries also conferred the **D.C. Pal Medal-2022** to Dr. K.J. Singh, Sr. Scientist, for his outstanding contributions in ethnobotany. Dr. Singh made a presentation about his contributions in ethnobotany and *ex-situ* conservation.

The invited speakers were felicitated by Dr. A.K. Shasany, Director, CSIR-NBRI. The programme ended with the vote of thanks proposed by Dr. Manjoosha Srivastava, Sr. Principal Scientist, CSIR-NBRI and the Secretary, Society of Ethnobotanists followed by the National Anthem.


Glimpses of the programme on Dr. S.K. Jain Memorial Lectures

Sanjeev K. Ojha
Anil K. Goel

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Report on National Workshop on Plant Taxonomy and Ethnobotany Organized by: IUC-BCBT: Department of Botany, University of Kerala in association with the Society of Ethnobotanists (Kerala Chapter): 25.11.2025 to 02.12.2025

The Inter University Centre for Biodiversity Conservation & Bioresources Technology (IUC-BCBT): Department of Botany, University of Kerala organized a National Workshop on **Plant Taxonomy and Ethnobotany** from 25.11.2025 to 02.12. 2025.

The inaugural function began with a prayer followed with the welcome address by Prof. E.A. Siril, Organizing Secretary, Department of Botany. Prof. A. Gangaprasad, Chairman, Emeritus Professor & Hon. Director, IUC-BCBT and Secretary, SEB, Kerala Chapter briefed about the workshop. Presidential address was delivered by Prof S. Shiburaj, Head, Dept. of Botany. Inaugural address was made by Prof. G. Prasad, Dean, Faculty of Science. Dr. Anil K. Goel, Former Chief Scientist, CSIR-NBRI, Lucknow & Vice President, Society of Ethnobotanists, Lucknow narrated briefly about the activities of the 'Society of Ethnobotanists' in online mode. Prof. (Dr.) P. M. Radhamany, Member Syndicate, University of Kerala & Emeritus Professor, Dr. Manjoosha Srivastava, Sr.Principal Scientist, CSIR-NBRI, Lucknow & Secretary, SEB and Prof. T.S. Swapna, Head, Department of Biotechnology, University of Kerala felicitated the occasion. Dr. A.K. Goel and Dr. Manjoosha Srivastava congratulated SEB, Kerala Chapter for supporting the event. Finally vote of thanks was delivered by Dr. K. Radhakrishnan, Principal Scientist (Retd), JNTBGRI, Palode.

Inaugural function

Inugural function

The first invited lecture in the forenoon session began with a talk by Dr. A.G. Pandurangan, Former Director, JNTBGRI, Palode and President, SEB, Kerala Chapter on **History of plant classification**. The second lecture was delivered by Dr. N. Mohanan, Chief Scientist (Retd.), JNTBGRI, Palode on **Floristics and Botanical Nomenclature**.

In the afternoon session, Dr. Pandurangan, spoke about **Herbarium Techniques Management** followed by a visit to Kerala University, Botany Dept. Herbarium under the guidance of Dr. N. Mohanan and Dr. Remya, Assistant Professor, Dept of Botany. The Day-2 (26.11.2025) was dedicated to the **Theme-2: Field Exploration and Hands-on Taxonomic Practices**.The entire day featured intensive practical training on plant collection, identification, and preparation of taxonomic keys, conducted by Dr. E.S. Santhoshkumar, Senior Technical Officer, JNTBGRI, Palode.

On Day-3 (27.11.2025), a field trip was organized to Mottammodu Kani Tribal Settlement, Kollar in the lap of the Western Ghats. The field trip provided participants with first-hand exposure to rich floristic diversity of the Western Ghats, ethnobotanical uses of plants, and *in-situ* conservation strategies. Interaction with tribal communities particularly Lekshmikutty Kanikkarithi, Padmashree Awardee for

Audience

Ethno-medical knowledge enhanced participants understanding about the traditional knowledge based systems and ethnobotanical applications.

Fourth day (28.11.2025) focused on Theme-4: **Modern Approaches in Taxonomy** began with a lecture on 'Floristic Diversity of the Western Ghats and Chemotaxonomic Exploration' by Dr. K. B. Rameshkumar, Principal Scientist, JNTBGRI followed by a talk on Zingiberaceae as a botanical treasure by Dr. Mathew Dan, Principal Scientist (Retd.), JNTBGRI. The session on **Molecular Taxonomy and Barcoding** was delivered by Dr. N.S. Pradeep, Principal Scientist and Director-in-Charge, MBGIPS, Kozhikode. Post-lunch sessions included lectures on **Relevance of Bioinformatics in Plant Taxonomy** by Dr. Sreekumar, HOD, Biotechnology Division, JNTBGRI and a practical demonstration on DNA Extraction, RAPD and Next Generation Sequencing by Dr. Sivu A. R., HOD, Department of Botany, Mahatma Gandhi College, Thiruvananthapuram.

The fifth day (29.11.2025) was devoted to Theme-5: **Ethnobotany and Ethnopharmacology**. Dr. K. Radhakrishnan delivered a comprehensive lecture on 'Ethnobotany- Principles and Practices'. This was followed by a session on 'Intellectual Property Rights and Sui Generis Protection of Traditional Knowledge and Biodiversity' by Dr. Praveen Raj, Sr. Principal Scientist, NIIST, Thiruvananthapuram. In the afternoon, Dr. A. Subramaniam, Former Director, JNTBGRI delivered 2 lectures on the 'Role of Ethnopharmacology in the Development of Standardized Phytomedicines, emphasizingdrug discovery from traditional medicinal knowledge.

The sixth day (01.12.2025) was focused on Theme-6: **Conservation and Sustainable Utilization**. Dr. N. Mohanan delivered a lecture on the 'Role of JNTBGRI in plant diversity conservation'. Dr. Jose Mathew spoke on the' Taxonomy and conservation of orchids'. Dr. Narayanan Nair, Sr. Principal Scientist (Retd.), CSIR-NBRI, Lucknow, discussed the 'Taxonomy and nomenclature of cultivated plants'. The final technical session was handled by Dr. Jabbar, Sr. Technical Officer, JNTBGRI who elaborated on Morpho-molecular seed characterization` and its significance in plant systematics.

With resource persons and participants

The final day (02.12.2025) featured a visit to the Central Laboratory for Instrumentation and Facilitation (CLIF), University of Kerala, providing participants with exposure to advanced analytical instruments. This was followed by a feedback and interaction session, where participants shared their experiences and suggestions. The workshop concluded with a valedictory session and distribution of certificates, marking the successful culmination of the academic program. The workshop significantly enhanced the scientific skills, research orientation, and conservation awareness of the participants.

A. Gangaprasad

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OBITUARY

Prof. K.S. Manilal (1938-2025)

Padma Shri Prof. Kattungal S. Manilal was born in Cochin on 17 Sept., 1938. He did undergraduate studies at Maharaja's College, Ernakulam and earned his M.Sc. and Ph.D. degrees in Botany from Sagar University, Sagar (MP). Prof. Manilal's interest in ***Hortus Malabaricus*** was inspired by his father at his very young age. During his postgraduate studies, he was on a study tour to Forest Research Institute (Now ICFRE), Dehradun, there he came across for the first time with a set of volumes of Hendrik van Rheede's ***Hortus Malabaricus*** in Latin. Dr. Manilal maintained his interest in this publication throughout his professional life until 1969, when he commenced serious work on the transliteration of ***Hortus Malabaricus.***

Prof. Manilal devoted over 35 years of his life for research and translation work of *Hortus Malabaricus*. This epic effort brought to the light main contents of this book, a wealth of botanical treatise on Malabar region that had largely remained inaccessible to the English-speaking scholars, because the entire text was in Latin. For this monumental work, he was conferred with the Padmshree in Jan., 2020.

As a plant taxonomist, Dr. Manilal worked on Flora of Silent Valley. He published over 200 research papers and nearly 15 books to his credit. He is credited for discovering over 14 species of flowering plants, varieties and combinations new to the science. For intensifying the taxonomic studies in India, he started the Indian Association for Angiosperm Taxonomy (IAAT) as Founder President. He was also an active life member of the Society of Ethnobotanists and a great source of inspiration for students pursuing the Ethnobotanical researches.

He left for heavenly abode in the early morning on 01 Jan., 2025 in his home at Kojikode (Calicut) at the age of 87 years. SEB members deeply condole the death of this great plant taxonomist and ethnobotanist.

Anil K. Goel

Dr. Palpu Pushpangadan (1944 – 2025)

Padma Shri Dr. P. Pushpangadan was born on 23 Jan., 1944, at Prakkulam in Kollam district (Kerala). After completing his B.Sc. Degree from the University of Kerala. He earned his M.Sc. and Ph.D. degrees in Botany from Aligarh Muslim University, Aligarh (UP). He began his scientific career in 1969 at CSIR-Indian Institute of Integrative Medicine (then RRL), Jammu. Later on, Dr. Pushpangadan moved to the Ministry of Environment, Forests & Wildlife, New Delhi, as the Chief Coordinator of All India Coordinated Research Project on Ethnobiology (AICRPE). Dr. Pushpangadan held several important leadership roles throughout his illustrious career, including the Director of the Tropical Botanic Garden & Research Institute (TBGRI), Thiruvananthapuram (Kerala), and subsequently the Director of the CSIR–National Botanical Research Institute, Lucknow from 1999 to 2006. These institutions saw significant developments in interdisciplinary research, capacity building, and international cooperation under his direction.

Dr. P. Pushpangadan helped to develop 'Jeevani', A herbal formulation based on 'Arogyapacha' plant (*Trichopus zeylanicus*), found in the forests of Western Ghats and traditionally used by Kani tribe to combat fatigue, enhance stamina, and improve immunity and mental alertness. He is best known for developing the world's first Equitable Benefit Sharing (EBS) model.

He received many national and international awards, such as the Padma Shri (2010), UN-Equator Initiative Prize (2002), UNEP Borlaug Award and JW Harshberger Medal (2000) of SEB. Dr. Pushpangadan was a Life Member of the Society of Ethnobotanists. His lifetime of exceptional scientific productivity is reflected in his more than 500 research publications, about 20 books, and over 200 patents. He guided several Ph.D. and M.D. students.

After his retirement, he was holding the position of Director General of Amity Institute for Herbal & Biotech Products Development till he breathed his last. Dr. Pushpangadan passed away on 18 Dec., 2025 at the age of 82 years, in Thiruvananthapuram. The Society of Ethnobotanists pays homage to the revered soul.

Sanjeev K. Ojha
Anil K. Goel

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INSTRUCTIONS FOR CONTRIBUTORS

The ***Ethnobotany*** is a half-yearly international journal which publishes research and peer-reviewed papers on all aspects of ethnobotany and related fields. All authors should be members of the Society. Annual members will be entitled to submit one paper in joint authorship of a life member only with year of their membership.

Manuscript in English, not exceeding 3000 words (including tables and references), typed in double space in 'Times New Roman' font (size 12 pt.) on one side of paper (21×28 cm) leaving 2.5 cms margin on all sides, should be submitted through mail (Larger manuscripts may be considered on payment). One page of tables or figures will be treated as 500 words. For extra matter Rs. 400/- will be payable for every 500 words or part thereof.

Manuscripts for publication should be sent to Dr. Anil Kumar Goel; Email: editor.ethnobotanyindia@gmail.com. Authors should also provide Hindi translation of the title of paper, author's address and abstract in brief.

In the title of the article only those words will have first letter as Capital which will ordinarily start with Capital letter in the text also, like names of ethnic groups, plant genera, names of authors, and other proper nouns, *for example*: *Traditional herbal remedies among Tharus of Bahraich district*.

Style: The title should be brief followed by name(s) of author(s), address and e- mail, an abstract (up to 150 words), and 4-6 keywords, Ethnobotanical, phytochemical, ethno-pharmacological and other data on plants must give proper reference of the voucher specimen, i.e. name, collector, number, locality, accession number and name of herbarium where specimens are deposited, Local names of plants and any words other than English (or the main language of the article) should be given in single inverted commas like 'Shivlingi', 'Sarpgandha', and 'Mukhia', 'Pujari'. In enumerations, genera and species should be given in the alphabetical order.

Nomenclature of plants: Authors must check very carefully the nomenclature and authors of plant names in their papers. Authors are advised to compare names with the latest published literature/references on Ethnobotany (i.e. *Dictionary of Indian Folkmedicine and Ethnobotany*), taxonomic revisions, floras, and different plant data bases like: Tropicos, IPNI, Plant List and POWO, etc., to ensure updated nomenclature of the plants. Similarly, names of the author(s) of the plant names should be abbreviated as per the Brummitt and Powell (1992) or the guidelines provided by them.

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Chapter in Book:
Kapoor, S.L. & Mitra, R. 1987. Preparation of Scientific and Technical Papers, Reports and Popular Articles – Some guidelines. P. 144-167. *In:* Jain, S.K. (ed.) *A Manual of Ethnobotany*. Sci. Publ., Jodhpur.

Book:
Dhawan, B.N. (ed.) 1986. *Current Research on Medicinal Plants in India*. I.N.S.A., New Delhi.
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