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COMPREHENSIVE ETHNO-BOTANICAL SURVEY AND CYTOMORPHOLOGICAL STATUS OF SOME IMPORTANT MEDICINAL PLANTS FROM HIMACHAL PRADESH-A NORTH INDIAN STATE

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ABSTRACT

The present study reports the wealth of medicinal plant resources of Himachal Pradesh, North Indian region and especially in the Lahaul and Spiti "Cold Desert" of higher altitude Himalayas. Ethnobotanical data was recorded for 63 plant species (5 from plains, 8 species from mid Himalayas and 50 from higher altitude Himalayas) of North Indian regions. The information was collected from tribal people, hakeems, elder villagers and traditional healers through different interview methods. Data for each species covers vernacular name, locality/ altitude, habit, part used, ethnobotanical use and dosage. Among these 63 medicinal plants, maximum number of times leaves are used against different ailments (55.56%), followed by roots (36.51%), flowers and fruits (30.16%), whole plant (19.05%), seeds (12.71%), bark (11.1%), stems and rhizomes (3.18%). These medicinal plants are used by local people against many ailments and well documented by different researchers worldwide. Along with comprehensive ethnobotanical studies, the complete cytomorphological analysis was also recorded for these reported medicinal plants from study areas with having few new chromosome reports. As per our knowledge, it is the first single constructive report available about the germplasm evaluation by using both cytomorphological and ethnobotanical analysis tools from these study areas of Himachal Pradesh.

KEYWORDS: Ethno-botany; Cytomorphology; First chromosomal report; Lahaul-Spiti; Himachal Pradesh; North India.

INTRODUCTION

The total natural and traditional association and interactions between man and his surroundings environment are defined as ethnobotany. It is an interdisciplinary science, which shows the significant association between plants and tribal's. It reveals the precious information on the unexplored and unexploited natural resources and gives us the new use of these natural resources. Ethnobotany promotes proper utilization and also to conserve these plant resources for further future use. As per different reports India is one of the richest biological heritages with more than 50 million tribal people under 300 tribal communities, constituting about 8% of the total population of the country (Anonymous 1994; Maheshwari 1987). About 15% of the total geographical area of the country is inhabited by the tribal's (Gupta 1987). The tribal ethnobotanical information is significant not for the tribal people themselves, but also beneficial for the whole world. Unfortunately, these old civilizations, traditional skills and beliefs are going to be lost due to modernization, industrialization and also by discarding the traditional lifestyle by younger generation. The people of the tribal areas are the repository of accumulated experience and knowledge about traditional uses of medicinal plants. But due to modern civilization into tribal areas, knowledge about the use of traditional herbal wealth is vanishing rapidly. It is well reported by all India ethnobotanical survey by Ministry of Environment and Forests, Government of India, that about 7500 plant species are used in traditional medicinal system by 4635 ethnic communities. World community is facing challenge to inventories and records all ethnobotanical informations before the traditional cultures are lost forever. The state of Himachal Pradesh has been extensively explored floristically by various workers such as: Atkinson 1882; Hooker 1872-1897; Collett 1902, with emphasis on taxonomy. Studies on diversity of medicinal and aromatic plants in different regions of the state have also been well known, such as: Kangra valley (Ahluwalia 1952; Uniyal and Chauhan 1971), Kullu (Rastogi 1960; Uniyal and Chauhan 1973; Dobriyal et al. 1997), Chamba (Gupta 1961; Shabnam 1964). As per earlier reports, the estimated number of higher plant species (angiosperms and gymnosperms) on this planet is 250,000 (Ayensu and DeFilipps 1978) with a lower level at 2, 15,000 (Cronquist 1981; 1988) and an upper level as high as 5, 00, 000 (Tippo and Stem 1977; Schultes 1972). Of these, only about 6% have been screened for biologic activity, and about 15% have been evaluated phytochemically (Verpoorte 2000). It is a fact that the 25% of all medical

prescriptions are based on substances derived from plants or plant-derived synthetic analogues (Gurib-Fakim 2006). Himachal Pradesh a hilly state has rich plant diversity due to varying degree of agro climatic zonation. In one of the earlier report it is clearly mentioned, that about 3500 known plant species recorded in the state and about 500 are reported on the medicinal value (Chauhan 2003). Keeping this in view, many researchers have explored time to time the indigenous knowledge of different parts of the area (Sharma and Mishra 2009; Gautam and Bhadauria 2008, 2009) and many more are still trying. The present study is therefore, a continuation of ongoing labors to explore the traditional knowledge and cultural practices in these study areas with the ultimate aim of evaluating them for diversity and utilization pattern and also to protect from disappearance of this treasure. As we know that ethnobotany is entirely and fundamentally a new field of research. It is highly mentioned in different research reports that if in this field plants investigated systematically and scientifically, it will yield result of great value of the archeologists, anthropologist, plant geographer, enthnobotanist, linguistics, botanists and phytochemists (Kumar and Choyal 2012). The plants of Himachal Pradesh have been deeply studied by different researchers and scientists, such as: wild plants of Himachal Pradesh (Sharma 1976); some commercially important medicinal plant of the Kullu forest division (Uniyal and Chauhan 1982); ethnomedicine and supplement food by Gaddis of Himachal Pradesh (Brij Lal et al. 1996; Chauhan 1999) described the medicinal and the aromatic plants of Himachal Pradesh; the ethno-botanical study of the useful plants of the Kullu district in Himachal Pradesh (Singh 1999); ethnobotanical studies of Gaddi- a tribal community of the Kangra district (Sharma et al. 2000); ethnobotanical wisdom of Gaddi tribe in the western Himalaya (Himachal Pradesh) (Singh and Kumar 2000); ethnobotany of Rawalsar (Mandi District), Himachal Pradesh (Thakur 2001); commercially importance of medicinal and aromatic plants of Parvati Valley (Himachal Pradesh) (Sharma et al. 2003); characterization of some traditional fermented food and beverages of Himachal Pradesh (Thakur et al. 2004); indigenous herbal remedies to cure skin disorders by natives of Lahaul-Spiti (Brij Lal and Singh 2008); traditional uses of medicinal plants of lower foot-hills, Himachal Pradash (Prakash and Aggarwal 2010); uses of plants in control of different diseases in Mandi district (Kaur et al. 2011); ethnobotanical uses of herbal shampoo of Shivalik hills, Himachal Pradesh (Kharwal and Rawat 2012); traditional phytotherapy for snake bites used by the rural people of Hamirpur district (Kumar and Choyal 2012).

As a part of our investigation on ethnobotanical inputs along with cytomorphological data for reported medicinal plants from Himachal Pradesh, the aim of this research work is to provide precise, truthful and detailed information of reported medicinal plants to future researchers worldwide. As per our knowledge, there is not even a single constructive report available about the germplasm evaluation by using both cytomorphological and ethnobotanical analysis from these study areas of Himachal Pradesh.

MATERIALS AND METHODS

The North Indian (Himachal Pradesh) medicinal plants have been extensively studied by using different parameters. These are given under the subsequent headings such as: exploration of medicinal plants diversity, germplasm evaluation by using cytomorphological and ethnobotanical analysis.

Plant Material

Area Surveyed and Identification of Plants

The extensive field surveys have been carried out in the North India especially from the higher altitude Himalayas of Himachal Pradesh to investigate the existing medicinal plants. Specific localities have been marked and information about these localities, where the collection tours have been made is provided in maps (Maps-I). For the exploration of cytomorphological diversity, collection tours have been made to different localities during different times of the study period 2006-2009. The various regions of Northern India (Himachal Pradesh) were surveyed during the study period for collection of some important medicinal plants include: Keylong, Trilokinath, Udaipur, Darcha, Losar, Kaza, Rahla fall, Rohtang Pass, Manali, Kullu, Chamba, Kangra, Palampur, Una, Baddi, Solan, Shimla, Fatehpur, Dhameta, Samkar and Indora of (Himachal Pradesh). Photographs of the area surveyed were arranged in (Plate-A). Ethno-botanically reported plant specimens were arranged in Table 1, and identified at the Botanical Survey of India (BSI, Northern Circle), Dehra Dun, Department of Biodiversity, IHBT (CSIR), Palampur and deposited in the Department of Botany, Punjabi University, Patiala (Punjab) India. Some of these plant specimens were photographed and illustrated in photographic plates (Plate-B).

Germplasm Evaluation

Genetic diversity of medicinal plants has been evaluated by using morphological, cytological and ethnobotanical parameters. The information on diversity, distribution, habitat preferences, habit, part used, medicinal uses, active principle of medicinal plants of North

India and ethnobotanical inputs/ informations were compiled with the help of tribals, local people and hakeems from different study areas and results were critically cross checked and compiled from different research publications and books (Kirtikar and Basu 1935, 1984; Chopra 1956; Chopra et al. 2007; Pullaiah 2006; Acharya and Srivastava 2008; Khanna et al. 2008; Khare 2007).

Cytomorphological Stuidies

Morphological Analysis

With the help of different morphological parameters from field observations, with varying phenotypic characters were recorded to find out new morphotypes. The detailed morphological data of so marked morphovariants and for all medicinal plants were recorded and summarized in Table 1.

Cytological Studies

Chromosome numbers of different medicinal plants were studied with the help of meiotic analysis of young flower buds by using standard acetocarmine squash method. The young flower buds were fixed in Carnoy's fixative (6 parts ethanol : 3 parts chloroform : 1 part glacial acetic acid) for 24-48 hrs and then stored in rectified spirit until use. For chromosomal preparations, anthers were squashed in 1% acetocarmine (Prepared by fluxing BDH carmine in 45% acetic acid). The chromosome counts were confirmed by observing a number of well spread PMCs and meiotic abnormalities if any, were analysed from many PMCs. Pollen viability was estimated by heating the mature pollen grains in 50% glycerol-acetocarmine staining. Well filled pollen grains with stained nuclei were taken as fertile whereas shrivelled or unstained nuclei as sterile. Photomicrographs were taken from temporary slides using Leica Qwin Digital Imaging System. The reported cytological data were presented for each medicinal plant and given in Table 1.

Ethnobotanical Studies

Inventorisation of ethno-botanical inputs and information regarding the local uses of medicinal plants for different medicinal purposes was collected from the diverse habitat of study areas by conducting regular field trips during 2006-2009. Various tribal people, local people and hakeems of the area were interviewed for the present study. As we know that maximum ethnobotanical information were collected from rural people. Study has been carried out in several time intervals during the period 2006–2009, to collect information on the medicinal, cultural and traditional uses of plants of the area. For these studied plants

about 80 peoples from different areas were consulted for information collection. The interviews were conducted for collecting information from community leaders, elderly persons of the villages and local medicine men. We have collected information by asking questions during the interview in native local language in order to minimize bias information. While, maximum information was collected from older individuals, but in some cases young people have also actively participated in the interview sessions. About eighty persons have been interviewed from different villages of the study area and most of the persons were farmers with a primary or little education and their age varied from 40-70 years. The final list of plants was prepared according to information obtained from local people, hakeems, medicine men and trivals. The floristic surveys were conducted throughout the study period in different area of North India. The plant specimens were collected during these surveys were identified at the Botanical Survey of India (BSI, Northern Circle), Dehra Dun, Department of Biodiversity, IHBT (CSIR) Palampur and deposited and preserved in the Department of Botany, Punjabi University, Patiala (Punjab) India. The reported field data was compared with literature on medicinal plants of Himachal Pradesh. Plants were identified and nomenclature with the help of "Flora of British India" (Hooker 1872-1897), Flora of Lahaul-Spiti and Flora of India. Some literatures of ethnobotany have also been considered like: Srivastava et al. 1992; Yadav and Suresh 2003; Pushpangadan and Kumar 2005; Thakur 2011; Gautam et al. 2011; Kumar and Choyal 2012; Sharma and Sood 2013.

RESULTS AND DISCUSSION

Cytomorphological Studies

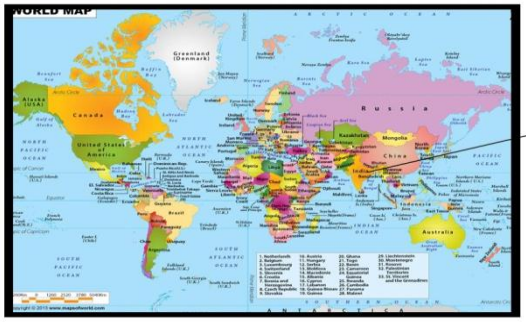
The detailed cytomorphological data have been compiled for different species of medicinal plants from Himachal Pradesh. The research data has been given for each plant on the basis of cytological studies and its morphological research analysis made during 2006-2009. Along with that the detailed information on diversity, distribution, habitat preferences, habit, part used, medicinal uses, active principle of each species were compiled from different sources. These medicinal important plants are reported in Table 1.

Ethnobotanical Studies

Presently the ethnobotanical data is collected from North Indian regions especially in the Lahaul and Spiti "Cold Desert" of higher altitude Himalayas. The information was collected from tribal people, hakeems, elder villagers and traditional healers through interview method. The collected information was verified by showing same species to different people and the actual information was considered if seemed to be valuable and true for further use. In the

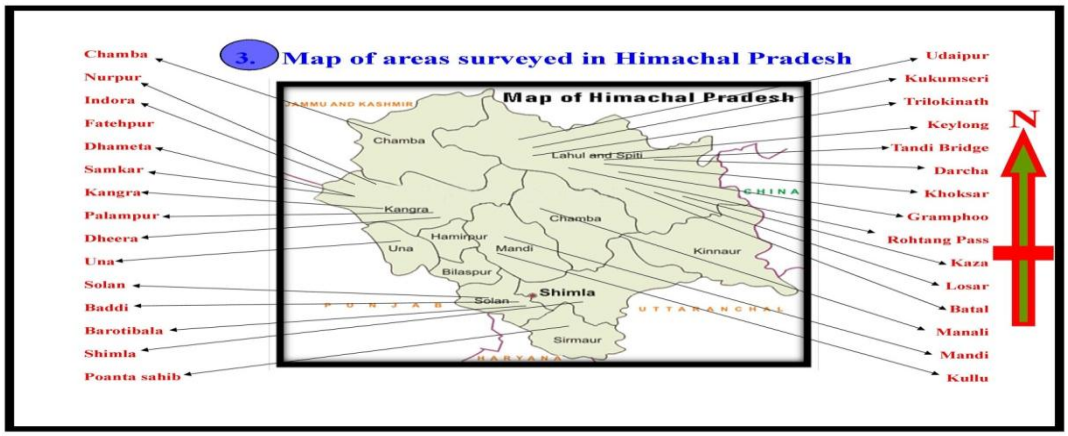
present study, such information was recorded for 63 plant species and data was arranged in the tabular form. Data for each species covers botanical name, family, vernacular name, locality/ altitude, habit, accession number, part used, ethnobotanical use and dosage (Table 1). In the present study, ethnobotanical data was recorded for 63 plant species (5 from plains, 8 species from mid Himalayas and 50 from higher altitude Himalayas) of North Indian regions especially from the Lahaul & Spiti "Cold Desert". The information was collected from tribal people, hakeems, elder villagers and traditional healers through interview method. Data for each species covers vernacular name, locality/ altitude, habit, part used, ethnobotanical use and dosage. Among these 63 medicinal plants, maximum number of times leaves are used against different ailments (55.56%), followed by roots (36.51%), flowers and fruits (30.16%), whole plant (19.05%), seeds (12.71%), bark (11.1%), stems and rhizomes (3.18%) (Graph 1). These medicinal plants are used by local people against many ailments such as: gastric disorders, rheumatism, fever, asthmatic problems, heart troubles, skin, liver and kidney problems, constipation, cough, cold, jaundice, arthritis, diabetes, sexual disorders and some plants are also used as nervine tonics. The detailed results are well reported and compiled in Table 1.

Plate-Maps-I



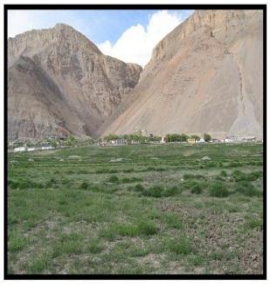
Map 1. World map

Map 2. Indian map

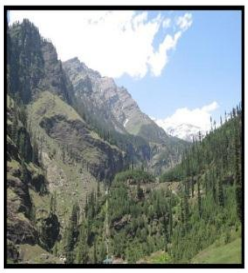


Map 3. Himachal Pradesh map

Plate-A.



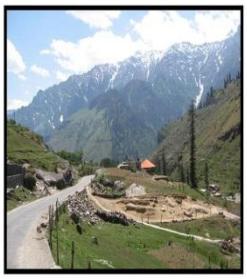
A View of Landscape, Vegetation and Naked Mountains at Kaza (3800m).



Photographs Showing Vegetation of Rahla fall (2501m) Regions (Manali)

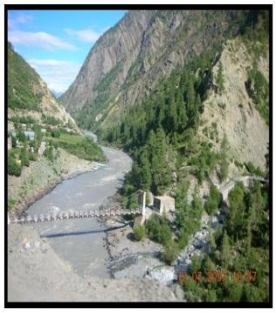
A View of Grazing Yaks (Losar-4079m).

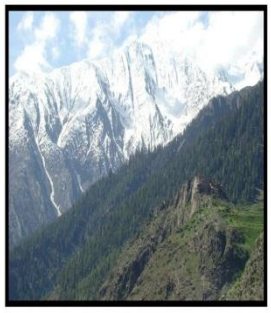
A Deep Valley with Snow Covered Mountains (Losar-4079m



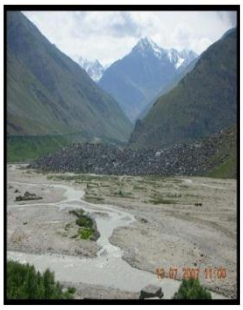
Road Side Vegetation Near Gullaba (Manali Region)

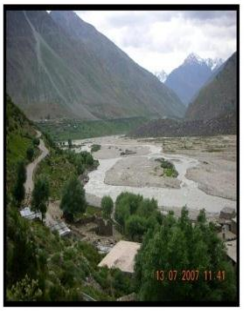
A View of Summer Pool at Sisoo (Lahaul Region)





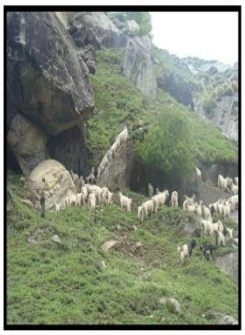
Wooden Bridge at Kukumseri (2730m) (A Typical Habitat of *P. hexandrum*) and Landscape of Trilokinath





A View Showing Riverine Moist Vegetation and Landscape at Darcha (3360m)

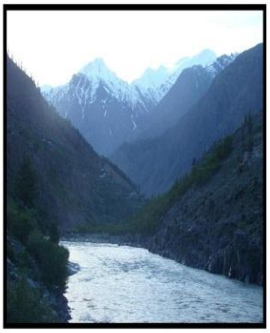
Landform and Vegetation (Views from Trilokinath-3020m)



Grazing Goats and Sheep (A threat to medicinal plants)

Gaddi People Watching their Goats and Sheep

Riverine Scrub and Scree Slopes (Trilokinath-3020m)



Riverine Habitat Around Chenab River

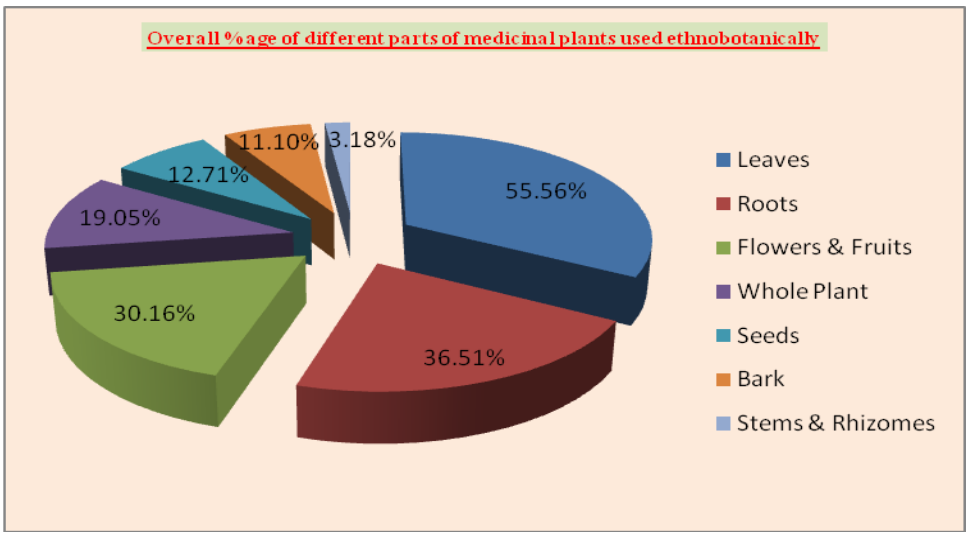
Local People Showing Use of Medicinal Plant

Collecting Ethnobotanical Data from A Local People

Plate-B


Allium carolinianum DC.
Arnebia euchroma (Royle ex Benth.) Johnston
Euphrasia himalaica Wettst.
Gentiana moorcroftiana Wall. ex G. Don.
Geranium wallichianum D. Don. ex Sweet
Artemisia maritima L.
Hyoscyamus niger L.
Lamium amplexicaule L.
Artemisia minor Jacq. ex Bess.
Artemisia parviflora Buch.-Ham. ex D. Don.
Lindelofia anchusoides (Lind.) Lehm.
Mentha arvensis L.
Mentha longifolia (L.) Huds.
Barleria spinosa Hook. ex Nees
Bryonopsis laciniosa Naud.
Nepata spicata Benth.
Ocimum kilimandscharicum Guerke
Pedicularis bicornuta Klotz. ex Klotz.
Pedicularis pectinata Wall. ex Benth.
Yellow, White and Purple Coloured Flowers in Three Morphotypes of Datura metel L.
Phlomis bracteosa Royle ex Benth
Pelargonium graveolens (Jacq.) L'Hérit.
Plantago depressa Willd.
Different Coloured Seeds in Three Morphotypes of D. metel L.
Podophyllum hexandrum Royle
Small Leaves, Greenish White Flowers of Morphotype-I of Withania somnifera.
Orange Coloured Berries of Morphotype-I of W. somnifera.
Saussurea albescens (DC.) Sch.-Bip.
Scrophularia koelzii Pennell
Thymus linearis Benth.
Veronica biloba L.
Large Sized Leaves, Yellowish White Flowers and Dark Red Berries of Morphotype-II of W. somnifera

Graph 1. Graphical elucidation of percentage of different parts of medicinal plants used ethnobotanically.



Highlights

1. Ethnobotanical research data of 63 plant species has been from Lahaul and Spiti "Cold Desert" of higher altitude Himalayas and from lower foot hills of Himachal Pradesh, India.
2. Maximum number of times leaves are used against different ailments (55.56%) followed by roots (36.51%).
3. The complete cytomorphological analysis was also recorded for these reported medicinal plants from study areas.
4. Few new chromosome reports have also been reported.
5. It is the first single constructive report available about the germplasm evaluation by using both cytomorphological and ethnobotanical analysis tools from these study areas of Himachal Pradesh (The Treasure of Medicinal Plants) (India).

Table 1. Ethnobotanical and Cytomorphological data collected for some plants from North India.

S. No.	Botanical Name (Family)	Meiotic Chromosome Number (n)/Status	Vernacular	Locality/Altitude	Habit	Accession No. PUN*	Part Used	Ethnobotanical Use	Dosage
1.	*Abutilon indicum* Linn. Sweet (Malvaceae)	n=21 (Abnormal meiosis)	Atibala, Kanghi	Solan (1463m)	Perennial Herb	52111	Roots, bark & seeds	Used in case of fever, nervine tonic, dysentery, leucorrhoea, piles, psoriasis, anti-inflammatory.	1-1/2 cups of water extract per day.
2.	*Adhatoda vasica* Nees (Acanthaceae)	n=17	Vasaka, Vasa	Houri Devi (458m)	Under shrub	52169	Leaves, roots & flowers	Plant is used to cure the fever, asthma, bronchitis, inflammation, whooping cough, jaundice, heart trouble, leprosy and rheumatism.	Boil 2-4g of dried plant parts in water and take 1-2 cups per day.
3.	*Allium carolinianum* DC. (Liliaceae)	n=8	Lo-adh (Spiti)	Kaza (3800m)	Rhizomatous plant	51959	Leaves and flower heads	Stimulant, diuretic, flowers and leaves are used in local dish “Thupka” used as a soup.	Fresh leaves or powder (5-8 g) per day in soups or dishes and also water extract (20 mL) per day early in the morning.

*PUN: Abbreviation for Herbarium, Department of Botany, Punjabi University Patiala as indicated in Index Herbariorum.

4.	*Amaranthus spinosus* L. (Amaranthaceae)	n=17	Chaulai Sarada (Lahaul)	Trilokinath (3020m)	Annual herb	51976	Roots	Plant is used as diuretic, in case of anaemia, piles, leucorrhoea and against gastric ulcer.	10g of fresh roots boiled in water and one cup of decoction taken daily to cure the gastric ulcer.
5.	*Andrographis peniculata* (Burm.) Nees (Acanthaceae)	n=25	Huilimb, Chirata, Kalmegh	Kullu (1230m)	Annual herb	51193	Leaves	Plant is used in case of dysentery, diabetes, influenza, swellings, bronchitis, piles, blood purifier and to cure the skin disease.	500mg of leaves powder taken three times a day.
6.	*Arnebia euchroma* Royle. (Boraginaceae)	n=7 (First chromosome number report from India)	Dymong, Dimok, Ratanjot	Losar (4079m)	Perennial herb	52026	Roots	Cold and cough, hair tonic, antiseptic and blood purifier	Water extract of dried roots (1-1/2 cups per day)
7.	*Artemisia maritima* L. (Asteraceae)	n=9 (Abnormal meiosis)	Khamchu, Phurang, Kunja, Shuomao, Neerchuo	Keylong (3350m)	Aromatic perennial herb	52014	Leaves, roots	Fever, pains, stomach ache, asthma	Powder roots 2 g in a day to cure asthma and water extract of leaves (20 g in 200 mL) prepared and 5

									mL of it given twice a day.
8.	*Astragalus rhizanthus* Royle (Fabaceae)	n=8 (Abnormal meiosis)	Jomuoshangae	Kaza (3800m)	Perennial herb	52208	Roots	Gastric, liver disorders	Powdered roots and leaves (1-3g) per dose given twice a day.
9.	*Atropa belladonna* L. (Solanaceae)	n=36	Sagangur	Baddi (602m)	Perennial herb	52178	Roots, leaves, seeds	Sedative, ulcer, antidote, nervous problems, cardiac muscle relaxant	Water extract of plant parts (25-50 mL) per dose twice a day.
10.	*Bacopa moneri* (L.) Pennell (Scrophulariaceae)	n=32	Brahmi	Shimla (2421m)	Perennial creeping herb	52048	Whole plant	Astringent, asthma, nerve and cardiac tonic, bronchitis	25 mL water extract thrice a day or dried powdered form (5-8 g) with one glass of milk twice a day.
11.	*Centella asiatica* (L.) Urb. (Apiaceae)	n=9 (Abnormal meiosis)	Brahmi, Mandukparni	Mandi (754m)	Herbaceous annual plant	52175	Whole plant	Brain tonic, useful for loss of memory, leprosy,	10-15 g of powdered form with milk or water twice a day.
12.	*Chenopodium album* L. (Chenopodiaceae)	n=9	Bathu, Aem	Keylong (3350m)	Annual herb	51984	Whole plant	Stomach disorders, constipation, soup	Leaves powder (2-4 g) per day for three days.
13.	*Chenopodium ambryosides* L.	n=16	Aiyaar	Keylong (3350m)	Annual herb	51992	Whole plant	Stomach disorders	One cup of leaves

	(Chenopodiaceae)								decoction each morning before eating for three consecutive days.
14.	*Chenopodium botrys* Linn. (Chenopodiaceae)	n=9	Sokana	Udaipur (2743m)	Glandular pubescent herb	51956	Whole plant	Herbal soup, pains, stomach disorders, semen problem.	Leaves decoction used to cure the gastric pain and also to cure the discharge of semen through urine.
15.	*Chenopodium foliosum* (Moench) Aschers. (Chenopodiaceae)	n=9 (First chromosome number report from India and abnormal meiosis)	Kupuledeo	Darcha (3360m)	Glabrous herb	52010	Leaves, fruits	Gastric disorders	1-2 cups of fresh leaves decoction in early morning used to cure the gastric problems.
16.	*Cichorium intybus* L. (Asteraceae)	n=9	Kasni, Chickory	Darcha (3360)	Perennial herb	52181	Roots	Carminative, anti-inflammatory, stomach ache, cardio tonic, jaundice, liver disorders, rheumatism, diarrhoea, asthma	One teaspoon root stock per 1/2 cup of cold water twice a day to cure numerous diseases.
17.	*Codonopsis ovata*		Golchokpa	Darcha	Perennial	52078	Leaves,	Rheumatic pains.	30g of herb

	Benth. (Campanulaceae)	n=8		(3360m)	herb		flowers		powder taken with one cup of water twice a day in case of rheumatic pains.
18.	*Convolvulus arvensis* L. (Convolvulaceae)	n=24	Gerachae	Kaza (3800m)	Creeping perennial herb	51960	Whole plant	Antiseptic, memory tonic, washing of cuts and wounds	Leaf paste is applied to cure skin problems, one cup of leaves decoction used per day as a memory tonic.
19.	*Cynoglossum zeylanicum* Thunb. ex Lehm. (Boraginaceae)	n=12	Kachi	Udaipur (2743m)	Biennial herb	52083	Roots	Applied on cuts, remove pains, improve digestion	Root decoction prepared in water and boiled to maximum, 4-6 teaspoons twice a day to treat indigestion and pain.
20.	*Datura metel* L. (Solanaceae)	n=12 (Abnormal meiosis)	Dhatura, Dhastur	Fatehpur (436m)	Under shrub	52092	Whole plant	Narcotic, asthma, fever, skin disorders, nervous system disorders	0.5g of seeds taken orally to treat the disorders of nervous system, leaf and seeds

									paste is applied to cure the skin disease.
21.	*Dactylorhiza hetagirea* (D. Don) Soo (Orchidaceae)	n=20 (First chromosome reports from world basis)	Angbolakpa, Sanchu, Hathpanja, Hathajadi, Salampanja	Darcha (3360m)	Marshy herb	52070	Roots, flowers	Kidney complaints, Aphrodisiac , sexual disorders, leucorrhoea	2-5 g of root powder given twice a day with milk.
22.	*Fragaria indica* Andrews. (Rosaceae)	n=35	Pallaya	Manali (2050m)	Perennial herb	52062	Leaves, flowers, fruits	Gastric disorders and source of energy	Leaves decoction used for treatment of swelling, flower decoction is used to increase the blood circulation, fruits are used externally to cure the skin disease.
23.	*Gentiana kurroo* Royle (Gentianaceae)	n=13 (First chromosome reports from world basis with abnormal meiosis)	Pangyin	Kaza (3800m)	Perennial herb	52180	Flowers, roots	Cough, stomach-ache	Boiled water extract (1/2 cup) twice a day.
24.	*Gentiana*		Tikta, Santik	Kaza (3800m)	Annual herb	52035	Aerial	Fever, rheumatic	Extract of

	moorcroftiana Wall. ex G. Don. (Gentianaceae)	n=13 (New chromosome count for the species)					parts	pains, gastric and liver disorders	leaves (15-25 mL) twice a day to cure the liver infection and disorders.
25.	*Gentiana pedicellata* D. Don. Grisb. (Gentianaceae)	n=10	Tikta	Keylong (3350m)	Annual herb	51970	Aerial parts	Rheumatic pains	Leaves powder (5-15 g) given with ½ glass of water.
26.	*Geranium wallichianum* D. Don. ex Sweet (Geraniaceae)	n=28 (New chromosome count for the species)	Porulue	Kaza (3800m)	Ascending perennial herb	53007	Aerial parts	Cough, jaundice, pains	2g of leaves powder given thrice a day.
27.	*Heracleum lanatum* Michx. (Apiaceae)	n=11 (First chromosome number report from India and abnormal meiosis)	Tunak, Tukar, Rasal	Trilokinath (3020m)	Hairy to pubescent herb	52204	Leaves, flowers	Liver complaints, arthritis, tooth ache	Leaves powder should be taken with milk to reduce liver problems.
28.	*Heracleum thomsonii* Clarke (Apiaceae)	n=11 (First chromosome reports from world basis with abnormal meiosis)	Raoe	Kaza (3800m)	Glabrous to pubescent herb	52032	Whole plant	Stomach ache, cough	Water extract (10-20 mL) given per day for three days.
29.	*Holarrhena*	n=11	Kuda, Kurchi	Samkar	Deciduous	52161	Seeds,	Gastric disorders,	2g dried bark

	antidysenterica Wall. (Apocynaceae)	(Abnormal meiosis)		(434m)	shrub		bark, leaves	relief from dysentery	powder is used twice a day to control dysentery.
30.	*Hyoscyamus niger* L. (Solanaceae)	n=17	Thangdum-langtang-tse, Dhandhura	Keylong (3350m)	Hairy tall herb	51963	Flowers, seeds	Tooth ache	Seed powder paste applied on the tooth for getting relief.
31.	*Lindelofia anchusoides* (Lind.) Lehm. (Boraginaceae)	n=12 (First Chromosome number report from India)	Shuyawaray	Losar (4079m)	Perennial herb	52061	Leaves	Wound healing properties, used to cure gastric disorders	Leaves paste is used to cure wounds and applied externally in case of skin problems.
32.	*Lindelofia longiflora* (Royle ex Benth.) Bail. (Boraginaceae)	n=12	Shawarang, Shuyawaray	Kaza (3800m)	Perennial herb	52034	Leaves	Stomach disorders, gastric pains.	Leaves decoction, ½ cup twice a day is used to treat the gastric pain.
33.	*Lonicera hypoleuca* Decne. (Caprifoliaceae)	n=9 (First chromosome reports from world basis with abnormal meiosis)	Karmeo	Darcha (3360m)	Pubescent herb	51955	Leaves, bark	Wound healer, antiseptic, kidney problems.	Decoction (1 cup twice a day) of leaves and bark is used for a week in case of kidney problems.
34.	*Mentha longifolia* (L.) Huds.	n=24	Madeenae	Udaipur (2743m)	Strongly aromatic	52029	Leaves	Gastric pains, cough, cold and	Fresh leaves may be

	(Lamiaceae)				herb			used in various recipes.	inserted into nostrils or in boiled water for inhalation of vapours, juice from leaves also used in case of gastric pain due to indigestion.
35.	*Origanum vulgare* L. (Lamiaceae)	n=15	Lameysha	Udaipur (2743m)	Hairy herb	51987	Whole plant	Asthma, cold, gastric disorders, herbal soups, tea rheumatism	Whole plant decoction (1-1/2 cup twice a day for one week) is used to cure the asthma, rheumatic pain, cold and gastric problems, tea made from leaves and flowers is useful to cure the influenza.
36.	*Oroxylum indicum* Vent. (Bignoniaceae)	n=15	Tatpalanga, Arul, Tetoli, Shyonaka, Arlu	Dhameta (435m)	Small Tree	52160	Roots, bark, leaves, fruits	Diarrhoea, dysentery, rheumatism, headache, ulcer, wounds.	1-2g bark powder used daily to compensate the loss of

									weight, cure rheumatism and also check diarrhoea. In case of dysentery 100g of stem bark and 50g of leaves are boiled in 250mL of water till the quantity become one third then the residue is sieved out and taken one glass twice a day for one week.
37.	*Pedicularis bicornuta* Klotz. ex Klotz. (Scrophulariaceae)	n=7 (Abnormal meiosis)	Langana sarpoea	Darcha (3360m)	Erect or sub-erect herb	52006	Leaves, roots	Body ache, joint pains	Powder material (5-12 g) with water twice a day.
38.	*Pedicularis longiflora* Rudolph. (Scrophulariaceae)	n=7 (First Chromosome number report from India with	Sarpoea	Trilokinath (3020m)	Perennial herb	52069	Flowers, leaves	Gastric disorders, bleeding from stomach through mouth	Boiled water extract (15-30 mL) given thrice a day for one week.

		abnormal meiosis)							
39.	*Pedicularis mollis* Wall. (Scrophulariaceae)	n=8 (Abnormal meiosis)	Lunguroe	Trilokinath (3020m)	Erect herb	52209	Flowers, leaves	Abdominal pain, joint pain	Powder (5-8 g) thrice a day early in the morning.
40.	*Pedicularis pectinata* Wall. ex Benth. (Scrophulariaceae)	n=8 (Abnormal meiosis)	Lunguroe-sarpoea	Darcha (3360m)	Erect herb	51985	Whole plant	Gastric disorders	Whole plant powder (10-15 g) taken twice a day for three days.
41.	*Phlomis bracteosa* Royle ex Benth (Lamiaceae)	n=14	Gehandha-sehangha	Trilokinath (3020m)	Pubescent herb	52011	Flowers, leaves	Stomach disorders and joint pain	Dried material (10 g) taken thrice a day to get relief for joint pains.
42.	*Picrorhiza kurrooa* Royle ex Benth. (Scrophulariaceae)	n=17	Honglen, Kutki	Rohtang (3978m)	Perennial herb	52019	Roots, rhizomes, flowers	Fever, blood purification	25-60 g of roots or rhizome powder boiled in water and extract of (10-25 mL) thrice a day for one week.
43.	*Plantago erosa* Wall. (Plantaginaceae)	n=12 (New chromosome count for the species with abnormal	Bhatti, Thrnay	Udaipur (2743m)	Perennial herb	52058	Fruits, seeds	Stomach disorders, constipation problems	Seed powder (5-10g) twice a day.

		meiosis)							
44.	*Plantago himalaica* Pilger. (Plantaginaceae)	n=6	Kharechaya	Losar (4079m)	Perennial herb	52087	Seeds, leaves	Constipation problems, itching	Extract of seeds in water should be used for three days (25-50 mL per day).
45.	*Plantago lanceolata* L. (Plantaginaceae)	n=6 (Abnormal meiosis)	Tharnay	Trilokinath (3020m)	Perennial herb	52199	Whole plant	Gastric disorders, constipation problems	Powder of plant material (5-10 g) should be given to cure gastric problems.
46.	*Plantago major* L. (Plantaginaceae)	n=6	Kharechaya	Batal (3960m)	Perenial herb	52113	Seeds, leaves	Constipation relief, joint pains	Roasted seeds (15 g) should be taken to cure the constipation and joint pains.
47.	*Podophyllum hexandrum* Royle (Berberidaceae)	n=6	Tandik, Demobkusu, Bankakri, Omosheya	Kukumseri (2730m)	Perennial herb	53010	Rhizomes, roots	Dysentery with blood, skin disorders, cough, tuberculosis	Powdered form of rhizome (2-6 g) given per day with honey to cure the cough and extract of (100 g) rhizome in water given.
48.	*Polygonum*	n=10	Naram,	Chatru	Under shrub	52073	Aerial	Gastric disorders	5 g powder

	alpinum All. (Polygonaceae)	(First Chromosome number report from India with abnormal meiosis)	Alepea	(3360m)			parts, stem bark		given with water thrice a day for gastric relief.
49.	*Polygonum barbatum* L. (Polygonaceae)	n=11	Neyoloe	Keylong (3350m)	Perennial herb	52080	Leaves, young stem	Cough, constipation, check dysentery	One teaspoon of leaves powder to relief from constipation.
50.	*Polygonum cognatum* Meissn. (Polygonaceae)	n=30 (First Chromosome number report from India)	Neyoloe, Kopedeo	Losar (4079m)	Perennial herb	52202	Aerial parts, stem	Stomach disorders	Leaves paste is used externally for skin diseases and its decoction (5-15mL) is used to cure gastric problems.
51.	*Polygonum minus* Huds. (Polygonaceae)	n=24 (First Chromosome number report from India)	Naram	Losar (4079m)	Perennial herb	51997	Aerial parts	Gastric and abdominal disorders	Young leaves are used for the preparation of decoction and taken orally for relief from abdominal pain.
52.	*Polygonum polystachyum* Wall. ex Meissn.	n=10 (First Chromosome	Naram, Neyoloe	Darcha (3360m)	Branched shrub	52008	Young leaves, stem bark	Check dysentery and relief from abdominal pain,	Stem bark (2-4g) taken with hot water to

	(Polygonaceae)	number report from India with abnormal meiosis)						liver disorders	check dysentery and young leaves decoction (1 cup for one week) is used to cure the liver disorders.
53.	*Polygonum recumbens* Royle (Polygonaceae)	n=10 (First chromosome reports from world basis with abnormal meiosis)	Kopedeo	Chatru (3360m)	Ascending perennial herb	52072	Bark, stem powder	Jaundice, liver disorders, gastric pain and blood purifier.	A paste made of the bark is applied in the treatment of various skin diseases. A decoction of the plant is given orally as a blood purifier and gastric abnormalities.
54.	*Rauwolfia serpentina* Benth. et Kurz (Apocynaceae)	n=11	Sarpgandha, Chandarika	Kullu (1362m)	Perennial undershrub	52190	Roots, leaves	Reducing blood pressure, hypnotic, stimulate the central nervous system, antidote to snake venom, eye problems	200mg of root powder with one cup of milk to reduce the blood pressure. Root paste and decoction is used as a antidote to

									snake venom
55.	*Rumex nepalensis* Spreng. (Polygonaceae)	n=27	Chomasae, Nabachalai	Kaza (3800m)	Perennial herb	51961	Leaves, flowers	Joint pains due to rheumatism	Powder of aerial parts (2-6 g) given with half glass of milk to reduce the joint pains.
56.	*Saussurea albescens* (DC.) Sch.-Bip. (Asteraceae)	n=13 (First chromosome reports from world basis)	Jangli kuth, Pong-choya, Buchae-sheong	Darcha (3360m)	Perennial herb	52054	Roots, leaves	Blood purifier, pain remover	Root powder (5 g) given per day to purify blood. Oil from plant used to apply on joints.
57.	*Saussurea hetromella* D. Don. Had. Mazz. (Asteraceae)	n=13 (New chromosome count for the species with abnormal meiosis)	Pong-choya,	Trilokinath (3020m)	Erect herb	52091	Flowers, roots, leaves	Blood purifier, body ache, joint pain, skin problems	Root paste is used over burnt part of the body to cure darkness of the skin, leaves and root decoction (15-20mL twice a day) is used to cure the joint pains and also as a blood purifier.
58.	*Taraxacum officinale* Wigg.	n=12	Handh, Kanphul, Sirshem,	Udaipur (2743m)	Perennial herb	52004	Whole plant, roots	Jaundice, liver disorders, rheumatic pains,	5 g of root powder given with milk

	(Asteraceae)		Manteok					body ache, fever	twice a day for one week to reduce jaundice.
59.	*Thalictrum foliolosum* DC. (Ranunculaceae)	n=7	Chaitra, Sarphar, Pilijari	Trilokinath (3020m)	Branched herb	53006	Roots	Ophthalmic treatment, diuretic, skin problems	Root powder is used for ophthalmic treatments and root paste is applied to check the skin problems.
60.	*Thymus linearis* Benth (Lamiaceae)	n=12 (First Chromosome number report from India with abnormal meiosis)	Ban-ajwain, Taksha nakpo	Udaipur (2743m)	Aromatic branched herb	52056	Fruiting parts and leaves	Tonic, child birth, whooping cough.	5g of it taken with 100mL of warm water and black salt in case of whooping cough and act as a tonic. Decoction of leaves helpful to relief from pain during child birth.
61.	*Valeriana jatamanasi* Jones (Valerianaceae)	n=16	Nihani, Tagar, Shivjadi, Sugandhbala	Chamba (996m)	Perennial herb	52018	Roots	Antiseptic, cardiac stimulant, diuretic, epilepsy, nervous problems, hysteria	One teaspoon of root powder is given three times a day for two weeks.
62.	*Verbascum*	n=18	Jeewar-londha	Keylong	Unbranched	52042	Seeds,	To check the	Whole plant

	thapsus L. (Scrophulariaceae)	(Abnormal meiosis)		(3350m)	herb		leaves, roots	abdominal pains, fever, asthma and dysentery	decoction is used to cure asthma, cough.
63.	*Withania somnifera* (L.) Dunal (Solanaceae)	n=12, 24 (Abnormal meiosis)	Ashvagandha, Asgandh, Indian ginseng	Kullu (1230m)	Perennial under shrub	52149	Roots,	Tonic, hypnotic, diuretic, narcotic, sedative, abortifacient, rheumatism, cough, delay ageing, greying of hairs, provide physical and mental strength	200-500mg of root powder should be taken with one glass of warm milk before sleep for 15 days to relief from all these diseases.

CONCLUSION

The plant biodiversity, traditional knowledge and cultural practices of the rural people are facing threat due to rapid urbanization and uncontrolled grazing in these study areas. Our attempts for this research work will not only provide recognition to this treasure, but also help in the conservation of these medicinal plants for further researchers worldwide. Ethnobotanical studies have a major role to play in modern drug development programmes from plant resources. There is a great role of botanists in the correct identification of the medicinal plants and allowing chemists to isolate and identify active principles and pharmacologists to investigate therapeutic properties. These traditional claims should be scientifically proved by using different analytical tools for production of drugs with least side effects. The present study revealed the information of plants used to cure different disorders. These plants are arranged in alphabetical order, with their family, local name, part/parts used and folk uses. The present study includes 63 plants belonging to 26 families. The popular use of herbal remedies among the rural people of Himachal Pradesh reflects the restoration of interest in the traditional medicine. The scientific validation of these remedies may help in discovering new drugs from these plant species. The information on therapeutic uses of plants may provide a great potential for discovering new drugs and promoting awareness among the tribal people to use them as remedy in health care system with supreme accuracy and knowledge.

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