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## Review Article

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## Ethnomedicinal plants used by the North Indian tribes in the management of urological diseases

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### ABSTRACT

Traditional herbal medicinal practices hold profound significance within rural and tribal communities, particularly in addressing prevalent urological diseases. This comprehensive review seeks to elucidate the indigenous knowledge concerning medicinal plants, specifically employed for the treatment of urinary infections. The compilation of data integrates diverse sources, including 'PubMed,' 'PubMed Central,' 'Google Scholar,' and 'Lens.org' publications. The investigation identifies 103 ethnomedicinal plant species distributed across 91 genera and 47 families, acknowledged for their efficacy against urinary and renal ailments in regions such as Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Rajasthan, and Ladakh. Notably, the Gujjar tribes, among 36 tribes studied, exhibit extensive proficiency in ethnomedicine and botanical knowledge. The systematic presentation of these plant species encompasses their scientific names, local nomenclature, associated tribes, utilized plant parts, modes of administration, and categorized diseases/ailments in a tabulated format. Predominantly utilized medicinal plants for urinary disorders encompass *Bergenia ciliata* (Haw.) Sternb., *B. stracheyi* (Hook.f. & Thomson) Engl., *Tribulus terrestris* L., *Malva verticillata* L., *Chenopodium album* L. Selected plant extracts, such as those from *Bergenia ciliata*, *Chenopodium album*, *Asphodelus tenuifolius*, and *Betula utilis*, have undergone scrutiny for their phytochemical and pharmacological attributes, showcasing promise for novel drug formulations against urological diseases. Ultimately, the findings of this study hold the potential to contribute substantively to the development of evidence-based alternative herbal interventions for urological diseases.

**Keywords:** Ethno medicinal Uses, North Indian tribes, Urinary system disorders, Urological diseases.

### INTRODUCTION

In clinical practice worldwide, urological infections are one of the most common types of infections. Hospital and community healthcare systems are both impacted by urinary tract infections (UTIs) from a clinical and financial standpoint. There is a wide variety of urological infections, from simple cystitis to septic shock and urosepsis. In all stages of life, UTIs are an important health problem. The frequency of UTIs varies with age and gender<sup>[1]</sup>. Worldwide, the absolute rate of urinary tract infections (UTIs) has risen by 60.40% from 252.25 million (95%UI (uncertainty interval): 223.31-279.3) in 1990 to 404.61 million (95%UI: 359.43-446.55) in 2019<sup>[2]</sup>. Approximately 1% of emergency admissions are caused by renal colic and complications associated with renal stones. A prevalence of 12% of kidney stones can be found across the world. In India, the prevalence of these infections is approximately 12%, with a slightly higher prevalence in the northern part of the country, where it is 15%<sup>[3]</sup>.

All three factors that contribute to the region's ethnobotanical diversity are present in India: botanical diversity, ethnic diversity, and rich traditions. India presents a wide variety of climatic and topographical conditions, from the cold, dry inland valleys of the far north of the Himalayas to the warm and humid Western Ghats. From the hot and dry regions of western Rajasthan to the rainiest place on earth i.e. Cherrapunji in the east. From the Himalayan highlands and northern Gangetic plains to the peninsular plateaus, long coastlines, and islands<sup>[4]</sup>. For thousands of years, humans have depended heavily on plants for food and for alleviating disease. Natural substances have constantly contributed greatly to the progress of modern medicine and still play an important role in drug development today. Terrestrial plants provide a unique and renewable resource for discovering novel medicinally active biomolecules because of their structural and biological diversity<sup>[5]</sup>. Currently, many drugs that are available on the market are from folk uses and indigenous communities' use of plants. The art of herbal healing is a very ancient tradition that has deep roots in Indian tribal culture and folklore. In most tribal communities, primary health care continues to be provided by local traditional healing systems<sup>[6,7]</sup>.

The Northern region of India is one of the largest in the country, encompassing: Jammu & Kashmir; Himachal Pradesh; Punjab; Uttarakhand; Haryana; Rajasthan; and Uttar Pradesh. It also includes Union Territory; Delhi, Chandigarh, and Ladakh. Figure 1 displayed a location map of North India<sup>[8]</sup> (<https://knowindia.india.gov.in/>). However, there is no tribal population in Punjab, Chandigarh, Haryana,

and Delhi. On the other hand, the remaining states i.e. Himachal Pradesh, Uttarakhand, Uttar Pradesh, Rajasthan, Jammu and Kashmir, and Ladakh have various tribal communities [9]. Indigenous people in various states rely primarily on ethnic medicinal plants for the treatment of various urological conditions. e.g. *Achillea millefolium* L. commonly known as Chuang, Biranjasif has been used in Ladakh and Himachal Pradesh by the Gaddi and Gujjar tribes against kidney diseases [10,11]. Additionally, kidney and bladder stones have been treated using *Bergenia ciliata* (Haw.) Sternb. and *B. stracheyi* (Hook.f. & Thomson) Engl. [10,12-14]. Similarly, *Macrotyloma uniflorum* (Lam.) Verdc. and *Malva verticillata* L. are prescribed for a number of kidney illnesses [13,15].

As there are no written documents available and traditional knowledge is transmitted orally from generation to generation, protecting this knowledge is a major challenge today. Hence, it is crucial to explore traditional knowledge about plants and document the available information scientifically to be able to apply it more widely in the future. A key aim of this study was to evaluate the potential of some selected plants traditionally used in North Indian tribes to treat urological disorders. This study presents scientific evidence and significant data about the medicinal plants used by the tribal folks of northern India.

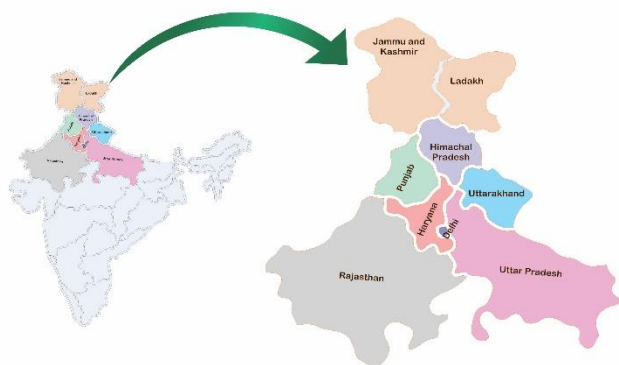


Figure 1: Location Map of North India

## METHODOLOGY

### Literature search strategy

The study was performed by three online databases: ‘PubMed’, ‘PubMed Central’, ‘Google Scholar’, ‘Lens.org’ for an inclusive review of North Indian medicinal plants for the treatment of urinary/renal disorders. For this study, Boolean (“OR” and “AND”) operator-based search query has been strategized and designed to obtain the data from the data sources. The keywords are used for the selected study region including ‘Rajasthan’, ‘Himachal Pradesh’, ‘Jammu’, ‘Kashmir’, ‘Ladakh’, ‘Uttarakhand’ and ‘Uttar Pradesh’; for the ailment of interest ‘urinary tract infections’, ‘urological disorders’, ‘renal disorders’ and ‘kidney stone’ and for medicinal uses ‘ethnomedicinal’, ‘ethnomedicine’, ‘Medicinal’ and ‘Traditional’; for local people ‘tribes’ and ‘tribal’. The article retrieved from the year between 2002 to 2022 and plant name and family were taxonomically validated by the Plants of the World online (<http://www.plantsoftheworldonline.org/>) and Global Biodiversity Information Facility (<https://www.gbif.org/en/>).

### Inclusion and exclusion criteria

The inclusion criteria were taken; articles published in English between 2002 to 2022; and research and review articles addressing plant species for treating certain kinds of renal/urinary disorders. Initially, the title and abstract of the article are used to determine its

applicability for this study, and then the full text of the selected articles is used to confirm its inclusion in the study. If the articles failed to give information about the North Indian region the research articles were excluded. At last, a master list of the selected scholarly articles was compiled in Microsoft Excel for further analysis.

## RESULTS AND DISCUSSIONS

In the current study, ethno-medicinal herbs from Northern states that were used by various tribes to treat various renal and urinary problems were examined. A total of 103 therapeutic plant species distributed among 91 genera and 47 families were used by 36 tribes to treat urinary disorders. Furthermore, 29 species have been used in dispelling kidney/urinary stones, 5 species are used against dysuria/painful urination, and 5 species are used in relieving inflammation of the kidney or urinary tract. In 33% of cases, the plant is administered as a decoction, 19% as powder, 10% as tablet, and 9 and 7% as juice and extract, respectively, and 28% as other forms. Among them, the *Bergenia ciliata* (Haw.) Sternb. and *Artemisia*, *Bergenia*, and *Sida* genus are used mostly by tribal people in the study location. Table 1 lists a number of plants utilized by various tribes in northern India to treat conditions affecting the urinary system. The scientific names, local names, and family of the plants were included along with the tribes, parts used, mode of administration, and Disease/Ailments.

There are 103 medicinal plants reported in this study, which are found in five states and one union territory used by 36 tribes in five states and one union territory. It is estimated that Ladakh has the highest number of plant species used by different tribes to treat urinary ailments followed by Rajasthan, Himachal Pradesh, Uttarakhand, Uttar Pradesh, and Jammu & Kashmir. A total of 27 plant species belonging to 24 genera were used by tribal people in Ladakh. Furthermore, in Rajasthan, 25 species belonging to 24 genera were used to treat urinary tract infections. Additionally, tribes in Himachal Pradesh used 23 plants distributed among 22 genera. Figure 2 showcases species and genera described by tribal groups in each state and union territory.

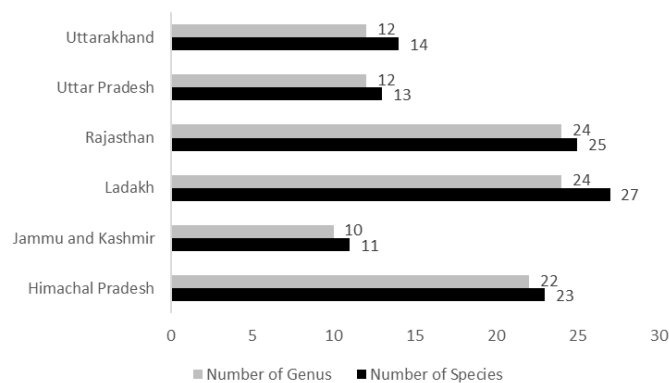


Figure 2: Utilization of herbal species against urinary ailments at the state/union territory level

A comprehensive analysis divulged that the 103 plant species belong to 47 families widely utilized by the locals and tribal of Northern India, majorly from Rajasthan, Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Uttarakhand, and Ladakh for the treatment of various urinary ailments belong to 36 tribes. Out of the 103 plants identified in this review, the Gujjar tribe utilizes 33 species making it the most prominent tribe of Northern States in this review, followed by Bhil (25 species); Damor, Garasia, and Kathodi (24 species each); Meena (22 species); Seharua (20 species); Dhanka, Naikara, and Patelia (19 species each); Buddhist tribal community (15 species); Gond, Kharwar (13 species each); Brokpa (11 species); Bhotia, Gaddi, Kiratas (9 species each); and the remaining 48 tribes represents less than five species each. Figure 3 represents the number of species belonging to different tribes.

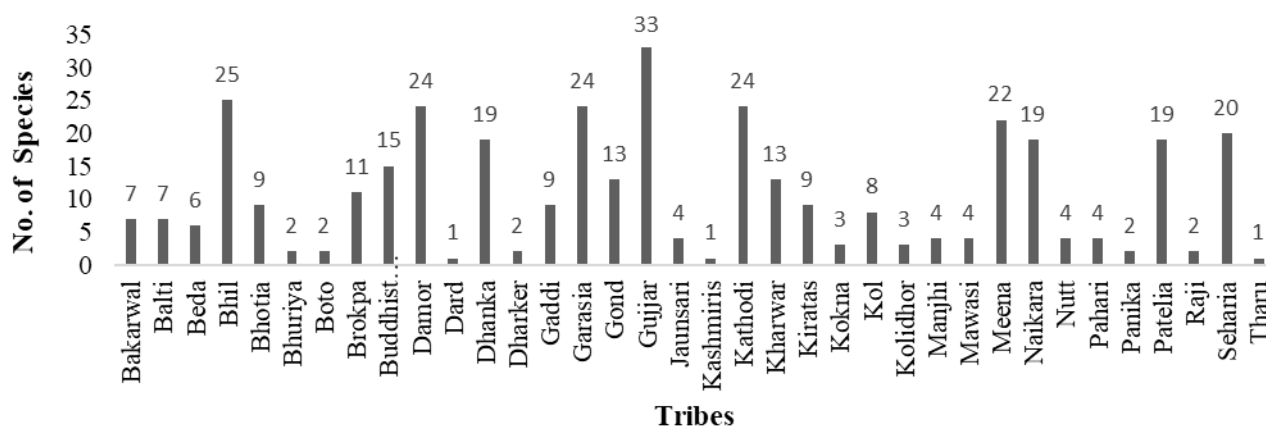


Figure 3: Number of species utilized by different tribes

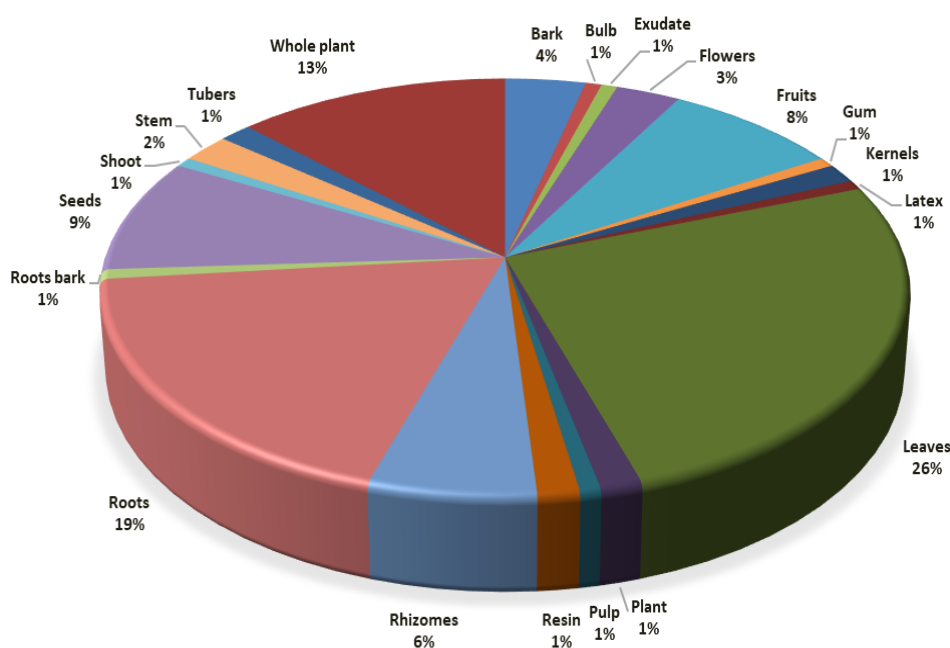


Figure 4: Plant parts (%) used by the Tribal people

There are medicinal values in almost every part of a plant, including roots, rhizomes, bark, shoots, stems, tubers, leaves, flowers, fruits, bulbs, exudates, gum, kernels, latex, pulp, resin, and seeds. Different parts may contain specific active ingredients that treat various conditions. Among various parts used for preparing medicine, leaves (34 species; 26%) were predominantly used, followed by roots (24 species; 19%), whole plant (17 species; 13%), seeds (11 species; 9%), fruits (11 species; 8%), rhizomes (7 species; 6%), bark (5 species; 4%), stem (3 species; 2%). Figure 4 shows the frequency (in %) of plant parts used by the tribal people. Many indigenous societies primarily use leaves to make herbal medications [10,16,22]. The ease of collecting leaves is one of the reasons why they are used more frequently than underground parts, flowers, fruits, seeds, etc. Moreover, leaves contain active sites for synthesizing various secondary metabolites from a scientific standpoint [33].

Asteraceae was the most preminent family with 11 species, followed by Malvaceae with 8 species; two families (Amaranthaceae, Fabaceae) recorded 6 species each following that two families four species each (Brassicaceae and Rosaceae) subsequently seven families (Apiaceae, Apocynaceae, Gentianaceae, Menispermaceae, Polygonaceae, Rutaceae, Saxifragaceae) three species each, ten families recorded two species each (Boraginaceae, Crassulaceae, Cucurbitaceae, Ebenaceae, Equisetaceae, Euphorbiaceae, Lamiaceae,

Orchidaceae, Poaceae, Solanaceae), whereas remaining 22 families were unspecific. Plants of the family Asteraceae have been mostly utilized as a therapeutic source in areas of Ladakh, Himachal Pradesh, Rajasthan, Jammu and Kashmir, and Uttarakhand of Northern India. It has been used against various urinary and renal ailments such as kidney pain & inflammation, burning sensation of the urine tract, kidney stones, bladder irritation, and painful urination. Asteraceae dominated this study in terms of the number of species; since communities are more likely to use species in families with more species, Asteraceae was most likely to be used by them [10,11,14,16,22].

**Pharmacological approach of the plants used by North Indian tribes to treat urinary system disorders**

Evidence-based medicinal plants offer a lot of potential as safe and effective alternative medications for chronic illnesses in today's world. Despite the fact that medicinal plants are a well-recognized aspect of complementary and alternative medicine, with efficacy backed by thousands of years of clinical experience in treating human ailments, many lack scientific backing because they are the result of experience-based medicine. Nevertheless, there were some examples of scientific evidence reported about the herbs traditionally used to treat urological disorders by North Indian tribes.

**Table 1:** Ethnomedicinal Plants used against Urological diseases by tribes of Northern India

Plant Name	Local Name	Family	States	Tribes	Part Used	Dose/ Administration	Disease/Ailments	Reference
<i>Abutilon indicum</i> (L.) Sweet	Jhumka	Malvaceae	Rajasthan	Bhil, Damor, Dhanka, Garasia, Kathodi, Kokna, Kolidhor, Naikara, Patelia, Meena, Seharla	Seed, Leaves	Extract	Urinary disorders	16
<i>Acacia leucophloea</i> (Roxb.) Willd.	Safed kikar	Fabaceae	Rajasthan	Bhil, Garasia, Damor, Kathodi	Leaves	Decoction orally	Urinary tract bleeding	17
<i>Achillea millefolium</i> L.	Chuang	Asteraceae	Ladakh	Buddhist tribal community	Leaves	Powder	Kidney pain & inflammation, Burning sensation of urine tract	10
<i>Aconogonum tortuosum</i> (D.Don) Hara	Biranjaisif	Asteraceae	Himachal Pradesh	Gaddi, Gujjar	Whole plant	Decoction	Kidney diseases	11
<i>Aegle marmelos</i> (L.) Correa	Serpalulu or Itimeng	Polygonaceae	Ladakh	Buddhist tribal community	Whole plant	Extract	Painful urination	10
<i>Aerva lanata</i> (L.) Juss. ex Schult.	Bil	Rutaceae	Himachal Pradesh	Kiratas, Gujjar	Fruits, Pulp, Bark		Renal problems	18
<i>Ageratum conyzoides</i> L.	Kannu	Amaranthaceae	Uttar Pradesh	Kol, Panika, Dharker, Bhuriya, Kharwar, Gond	Whole plant	Decoction or Juice	Urinary problems	19
<i>Agrimonia pilosa</i> Aitch.	Gana gaaju	Asteraceae	Rajasthan	Bhil, Damor, Dhanka, Garasia, Kathodi, Naikara, Patelia, Meena, Seharla	Leaves	Extract	Kidney stone, Urinary tract troubles	16
<i>Agropyron repens</i> (L.) P.Beauv.	Kanaula	Rosaceae	Himachal Pradesh	Gujjar			Urinary problems	15
<i>Althaea rosea</i> (L.) Cav.	Zamak	Poaceae	Ladakh	Buddhist tribal community	Rhizomes	Powder	Bladder irritation	10
<i>Amaranthus caudatus</i> L.	mDog-ldan pho- lcam., Mo-tog-ha-lo	Malvaceae	Ladakh	Buddhist tribal community	Roots	Tablets	Kidney pain & inflammation, Burning sensation of urine tract	10
<i>Amaranthus spinosus</i> L.	Love lies bleeding	Amaranthaceae	Rajasthan	Bhil, Damor, Dhanka, Garasia, Kathodi, Naikara, Patelia, Meena, Seharla	Leaves	Extract	Kidney stone	16
<i>Amygdalus communis</i> L.	Jangali chauli	Amaranthaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharla, Bhil, Damor, Dhanka	Root	Paste	Irritation in urinary duct	16
<i>Angelica glauca</i> Edgew.	Badam	Rosaceae	Himachal Pradesh	Kiratas, Gujjar	Kernels		Urinal troubles	18
<i>Arctium lappa</i> L.	Lcha-ba, Angelica Micah or Pizums, Byi-bzung, Greater burdock	Apiaceae	Ladakh	Balti, Brokpa, Beda	Roots	Powder	Kidney heat	12
<i>Arenaria bryophylla</i> Fernald	Arctium lappa L.	Asteraceae	Ladakh	Buddhist tribal community, Brokpa	Roots, Seed	Decoction, Powder	Kidney stone, Urinary bladder cysts, Burning urination	10, 12
<i>Arnebia euchroma</i> (Royle ex Benth.) I.M.Johnst.	Lekhum	Caryophyllaceae	Ladakh	Buddhist tribal community	Whole plant	Tablets	Kidney pain & inflammation, Burning sensation of urine tract	10
<i>Artemisia dracunculoides</i> L.	Demok or Dre-mok	Boraginaceae	Ladakh	Buddhist tribal community	Roots	Tablets	Kidney and urinary disorders	10
<i>Artemisia parviflora</i> Roxb. ex D.Don	tsa-chheh or Shersing or Burtse	Asteraceae	Ladakh	Buddhist tribal community	Whole plant	Tablets	Bladder irritation	10
	Khamang	Asteraceae	Ladakh	Buddhist tribal community	Whole plant	Tablets	Painful urination	10

<i>Artemisia sieversiana</i> Ehrh. ex Willd.	Khamchu	Asteraceae	Ladakh	Buddhist tribal community	Leaves	Tablets	Kidney pain & inflammation, Burning sensation of urine tract	10
<i>Asparagus racemosus</i> Willd.	Satwar	Asparagaceae	Uttar Pradesh	Kharwar, Gond, Kol, Nutt, Manjhi, Mawasi	Root	Decocion	Urinary troubles	20
<i>Asphodelus tenuifolius</i> Cav.	Piazi	Asphodelaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Sehar, Bhil, Damor, Dhanka	Leaves	Decoction	Kidney stone	16
<i>Astragalus tribulifolius</i> Benth. ex Bunge	Yanglo	Fabaceae	Ladakh	Buddhist tribal community	Whole plant	Tablets	Bladder irritation	10
<i>Avena sativa</i> L.	Yupo	Poaceae	Ladakh	Buddhist tribal community	Seeds	Powder	Burning sensation of urine	10
<i>Berberis dictyophylla</i> Franch.	Sker-pa, Netleaf barberry	Berberidaceae	Ladakh	Brokpa	Bark	Tea	Nephritis	12
<i>Bergenia ciliata</i> (Haw.) Sternb.	Zakhmihayat, Silphara, Palfut, Zakhmehayat, Zakheyat,	Saxifragaceae	Jammu and Kashmir	Dard, Kashmiris, Gujjar, Bakarwal, Pahari	Root, Rhizomes	Dried	Renal/urinary disorders as kidney and bladder stones	21, 22
	Pasanbheda, Winter begonia, Silphori	Saxifragaceae	Uttarakhand	Jaunsari, Bhotia	Root, Leaves	Decoction, Powder	Kidney stone	13, 14
	Pasanbheda, Winter begonia	Saxifragaceae	Ladakh	Balti, Brokpa, Beda	Whole plant	Powder	Renal calculi	12
	Pathar phod	Saxifragaceae	Himachal Pradesh	Gaddi, Gujjar	Rhizome	Powder	Kidney stones	11
<i>Bergenia ligulata</i> Engl.	Pasher Bhed, Bhotia Chai, Pashanbhed	Saxifragaceae	Uttarakhand	Bhotia	Rhizome, Leaves	Chewing, Powder	Kidney stone, Urinary disorders	14, 23
<i>Bergenia stracheyi</i> (Hook.f. & Thomson) Engl.	Silphora, Gneepati	Saxifragaceae	Uttarakhand	Bhotia	Root	Chewing, Powder	Urinary and Kidney trouble, Urinary calculi	23
	Tiang or gatilas	Saxifragaceae	Ladakh	Buddhist tribal community	Rhizomes	Powder	Kidney stone	10
	Kapdolu	Saxifragaceae	Himachal Pradesh	Gujjar	Root		Kidney stone	24
<i>Beta vulgaris</i> L.	Ullam gadda	Amaranthaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Sehar, Bhil, Damor, Dhanka	Rhizome	Juice	Kidney stone	16
<i>Betula utilis</i> D.Don	Bhuj ptr	Betulaceae	Himachal Pradesh	Gaddi, Gujjar	Resin, Leaves	Decoction Orally	Urinary tract infection	25
<i>Boerhaavia diffusa</i> L.	Chotwa bhaji, Patharchatta	Nyctaginaceae	Uttar Pradesh	Gond, Kharwar	Roots		Kidney, Urinary diseases	26
<i>Bombax ceiba</i> L.	Silk cotton tree	Malvaceae	Rajasthan	Bhil, Damor, Dhanka, Garasia, Kathodi, Kokna, Kolidhor, Naikara, Patelia, Meena, Sehar	Stem, Bark	Decoction	Urinary problems	16
<i>Bryophyllum pinnatum</i> (Lam.) Oken	Patharchatt	Crassulaceae	Himachal Pradesh	Gaddi, Gujjar	Leaves	Raw	Kidney stones	11
<i>Callicarpa macrophylla</i> Vahl	Daya, Daiya	Lamiaceae	Uttarakhand	Jaunsari, Raji	Fruits, Leaves	Orally	Urinary trouble	23, 27
<i>Capsella bursa-pastoris</i> (L.) Medik.	Shamso or Sog-ka	Brassicaceae	Ladakh	Buddhist tribal community	Leaves	Tablets	Haemorrhage of kidney	10
<i>Carissa congesta</i> Wight	Karonda	Apocynaceae	Rajasthan	Sehar, Bhil	Unripe fruits	Vegetable	Stone problems	28
<i>Carum carvi</i> f. <i>gracile</i> (Lindl.) H.Wolff	Umbu, Kosnyot or Go-nyod or Go-sNyod	Apiaceae	Ladakh	Buddhist tribal community	Seeds	Powder	Bladder irritation	10
<i>Cephalanthera longifolia</i> (L.) Fritsch	Dophalo	Orchidaceae	Jammu and Kashmir	Gujjar, Bakarwal	Rhizome	Crushed	Dysuria	29

<i>Ceropegia bulbosa</i> Roxb.	Khadula	Apocynaceae	Rajasthan	Bhil, Damor, Dhanka, Garasia, Kathodi, Kokna, Kolidhor, Naikara, Patelia, Meena, Seharia	Tubers	Decoction orally	Urinary bladder stone	16
<i>Chenopodium album</i> L.	Chilua	Amaranthaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharia, Bhil, Damor, Dhanka	Leaves	Cooked as vegetable	Urinary trouble	16
	Sarmay	Amaranthaceae	Jammu and Kashmir	Gujjar	Leaves, Shoot		Urine infections	30
<i>Citrus medica</i> L.	Limbu	Rutaceae	Rajasthan	Bhil, Meena, Garasia, Damor, Kathodi	Fruit	Juice	Kidney stone	17
<i>Cocculus hirsutus</i> (L.) W.Theob.	Tikri-Bel	Menispermaceae	Rajasthan	Bhil, Meena, Garasia, Damor, Kathodi	Root	Decoction	Urinary tract inflammation	17
<i>Commiphora wightii</i> (Arn.) Bhandari	Gugul	Burseraceae	Rajasthan	Bhil, Garasia, Damor, Kathodi	Gum, Resin	Infusion orally	Urinary obstruction	17
<i>Cordia dichotoma</i> G. Forst.	Lasura	Boraginaceae	Himachal Pradesh	Kiratas, Gujjar	Leaves, Fruits, Bark		Urinary problems	18
<i>Costus speciosus</i> (J.Koenig) Sm.	Mahalakri	Costaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharia, Bhil, Damor, Dhanka	Tubers	Decoction orally	Urinary ailments	16
<i>Cucumis melo</i> L.	Phot	Cucurbitaceae	Himachal Pradesh	Kiratas, Gujjar	Fruits, Seeds, Kernels		Urinary troubles	18
<i>Cucumis sativus</i> L.	Kakree	Cucurbitaceae	Uttarakhand	Bhotia	Seeds	Powder	Urinary disorders, Kidney stone	12, 23
<i>Diospyros melanoxylon</i> Blume	Timru, tendu	Ebenaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharia, Bhil, Damor, Dhanka	Fruit, Flower, Bark	Powder	Urinary tract disorders	16
<i>Diospyros melanoxylon</i> Roxb.	Tendu	Ebenaceae	Uttar Pradesh	Gond, Kharwar	Seeds	Roasted	Urinary diseases	26
<i>Embllica officinalis</i> Gaertn.	Ambala	Phyllanthaceae	Himachal Pradesh	Kiratas, Gujjar	Fruits		Urinary troubles	18
<i>Enicostema</i> <i>verticillatum</i> (L.) Engl.	Naarne, Nahli, Kadava	Gentianaceae	Rajasthan	Bhil, Meena, Garasia, Damor, Kathodi	Whole plant	Extract	Dysuria	17
<i>Epilobium latifolium</i> Matt.	Byar-pan-chu-tse, Dwarf fireweed	Onagraceae	Ladakh	Balti, Brokpa	Leaves	Decoction	Urine obstruction	12
<i>Equisetum arvense</i> L.	Trote-gah	Equisetaceae	Jammu and Kashmir	Gujjar, Bakarwal, Pahari	Whole plant	Powder	Kidney infection (Stone)	22, 29
<i>Equisetum palustre</i> L.	Trote-gah	Equisetaceae	Jammu and Kashmir	Gujjar, Bakarwal	Plant	Dried	Kidney stones	29
<i>Euphorbia hirta</i> L.	Dhudia	Euphorbiaceae	Himachal Pradesh	Gaddi, Gujjar	Exudate	Extract	Kidney stones	11
<i>Evolvulus alsinoides</i> (L.) L.	Neeli Shankhpusphi, Shankhpusphi	Convolvulaceae	Uttar Pradesh	Kharwar, Gond, Kol, Nutt, Manjhi, Mawasi, Panika, Dharker, Bhuriya	Root, Leaves	Decoction, Juice	Urinary problems	19, 20
<i>Fagopyrum esculentum</i> Moench	Kathu	Polygonaceae	Himachal Pradesh	Gujjar			Urinary complaints	15
<i>Ficus benghalensis</i> L.	Gular	Moraceae	Uttar Pradesh	Kharwar, Gond, Kol, Nutt, Manjhi, Mawasi	Latex	Decoction	Urinary disorders	20
<i>Foeniculum vulgare</i> Mill	Saunf	Apiaceae	Himachal Pradesh	Kiratas, Gujjar	Leaves, Seeds, Fruits		Urinary troubles	18
<i>Fritillaria roylei</i> Hook.	Shethkhar	Liliaceae	Jammu and Kashmir	Gujjar	Bulb	Powder	Urinary tract infections	30
<i>Gentiana kurroo</i> Royle	Nilkanth	Gentianaceae	Jammu and Kashmir	Gujjar	Root	Decoction	Kidney and Urinary tract infections	30
<i>Glycine max</i> (L.) Merr.	Kala bhatt	Fabaceae	Uttarakhand	Bhotia	Seeds	Boiled	Kidney stone	13

<i>Gomphrena celosoides</i> Mart.	Gomphrena weed	Amaranthaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharlia, Bhil, Damor, Dhanka	Whole plant	Juice + <i>Piper nigrum</i> + lemon juice	Kidney stone, Urinary tract troubles	16
<i>Grewia flavescens</i> Juss.	Kali-Siali	Malvaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharlia, Bhil, Damor, Dhanka	Root	Root powder decoction	Bleeding in urinary tract	16
<i>Halenia elliptica</i> D. Don	Chirata	Gentianaceae	Himachal Pradesh	Gaddi, Gujjar	Whole plant	Decoction	Kidney problems	11
<i>Hemidesmus indicus</i> (L.) R.Br.	Anantamul, Kapuri	Apocynaceae	Uttar Pradesh	Gond, Kharwar	Roots	Juice	Urinary diseases	26
<i>Herminium monorchis</i> (L.) R.Br.	Bye-lche-lag-pa, Musk orchid	Orchidaceae	Ladakh	Brokpa	Roots	Dried	Kidney heat	12
<i>Hypericum perforatum</i> L.	Chie	Hypericaceae	Jammu and Kashmir	Gujjar, Bakarwal	Leaves	Tea	Urinary disorders	29, 30
<i>Iris hookeriana</i> Foster	Mazaer-mund	Iridaceae	Jammu and Kashmir	Gujjar	Rhizome	Powder	Urine infections	30
<i>Juniperus recurva</i> Buch.-Ham. ex D.Don	Shug-pa-tser-chan, Drooping juniper	Cupressaceae	Ladakh	Balti, Brokpa, Beda	Leaves	Powder	Kidney problems	12
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Ajubi/Sprout leaf plant	Crassulaceae	Uttarakhand	Tharu, Gujjar	Leaves	Extract	Renal calculi, Infection in urinary bladder	31
<i>Macrotyloma uniflorum</i> (Lam.) Verdc.	Gaheth	Fabaceae	Uttarakhand	Bhotia	Seeds	Boiled	Kidney stone	13
	Kolth	Fabaceae	Himachal Pradesh	Kiratas, Gujjar	Seeds		Urinary problems	18
	Sochali	Malvaceae	Himachal Pradesh	Gujjar			Urinary complaints	15
<i>Malva verticillata</i> L.	Suchili or Cam-pa-ma-ning	Malvaceae	Ladakh	Boto	Whole plant	Decoction	Removes blocked urine	10
<i>Mangifera indica</i> L.	Aaam, Amb	Anacardiaceae	Himachal Pradesh	Gaddi	Fruit		Kidney stone	32
<i>Murraya koenigii</i> (L.) Spreng.	Meetha neem, Curry leaves, Gandla	Rutaceae	Himachal Pradesh	Kiratas, Gujjar, Gaddi	Leaves, Roots		Renal troubles; Kidney pain	18, 32
<i>Nasturtium officinale</i> W.T.Aiton	Chuch	Brassicaceae	Himachal Pradesh	Gujjar			Kidney complaints	15
<i>Pedaliium murex</i> L.	Dakhigokhru	Pedaliaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharlia, Bhil, Damor, Dhanka	Fruits	Decoction	Continuance of urine and other complaints of urinary system	16
<i>Pedicularis siphonantha</i> D.Don	Singmarore, Phakchang	Orobanchaceae	Jammu and Kashmir	Bakarwal, Pahari	Flowers	Decoction	Urinary disorders	22
<i>Perovskia abrotanoides</i> Kar.	Iskiling or Tarobu	Lamiaceae	Ladakh	Boto	Leaves	Decoction Orally	Controls painful urination	10
<i>Polygonum aviculare</i> L.	Byi-na-sa, Knotgrass	Polygonaceae	Ladakh	Balti, Brokpa, Beda	Whole plant	Decoction	Obstruction of urine, Burning sensation during urination	12
<i>Potentilla argyrophylla</i> Wall. ex Lehm.	Ratanjot	Rosaceae	Himachal Pradesh	Gaddi, Gujjar	Leaves	Decoction	Kidney stones	11
<i>Raphanus sativus</i> L.	Muli	Brassicaceae	Himachal Pradesh	Kiratas, Gujjar	Roots, Seeds		Kidney stones	18
<i>Ricinus communis</i> L.	Arandi	Euphorbiaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharlia, Bhil, Damor, Dhanka	Root	Decoction + half gram sunthi + one gm of heeng + common salt	Kidney stones, Urinary tract troubles	16
<i>Rosa sp.</i>	Gulab	Rosaceae	Uttarakhand	Bhotia	Leaves	Juice	Urine infection of children	14
<i>Saussurea amabilis</i> Kitam.	Sau-ama	Asteraceae	Jammu and Kashmir	Gujjar, Bakarwal, Pahari	Leaves	Decoction	Urinary problems	22
<i>Saussurea obvallata</i> Nakai	Brahmakamal	Asteraceae	Uttarakhand	Bhotia	Flower	Cooked	Urine tracts infections	14
<i>Sida acuta</i> Burm.f.	Bariari	Malvaceae	Uttar Pradesh	Gond, Kharwar	Plant	Decoction	Urinary diseases	26

<i>Sida cordifolia</i> L.	Kungyi	Malvaceae	Uttar Pradesh	Gond, Kharwar	Whole plant	Decoction	Urinary diseases	26
<i>Sida rhombifolia</i> L.	Khareti	Malvaceae	Uttarakhand	Raji	Root bark	Powder with milk	Urinary troubles	23, 27
<i>Smilax perfoliata</i> Lour.	Ramdatun	Smilacaceae	Uttar Pradesh	Gond, Kharwar	Root	Powder	Urinary troubles	26
<i>Solanum surattense</i> Burm.f.	Ber kaleli, Neeli kateti	Solanaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharja, Bhil, Damor, Dhanka	Root	Root powder + Curd	Kidney stone, Urinary tract troubles	16
<i>Tanacetum dolichophyllum</i> (Kitam.) Kitam.	Mkhan-chung-ser-mgo/ Garden tansy	Asteraceae	Ladakh	Brokpa, Beda	Flowers	Boiled	Renal diseases	12
<i>Taraxacum officinale</i> F.H.Wigg.	Gahri phul	Asteraceae	Himachal Pradesh	Gujjar			Kidney diseases	15
<i>Tephrosia purpurea</i> (L.) Pers.	Sarphankha	Fabaceae	Uttar Pradesh	Gond, Kharwar	Whole plant	Decoction	Urinary disorders	26
<i>Thlaspi arvense</i> L.	Bre-ga, Field pennycress	Brassicaceae	Ladakh	Balti, Brokpa, Beda	Leaves	Decoction	Kidney diseases	12
<i>Tinospora cordifolia</i> (Willd.) Hook f.	Giloya	Menispermaceae	Uttar Pradesh	Gond, Kharwar	Root, Stem	Decoction	Urinary diseases	26
<i>Tinospora sinensis</i> (Lour.) Merr.	Giloe	Menispermaceae	Uttarakhand	Jaunsari	Stem, Leaves	Juice	Urinary trouble	23
<i>Tribulus terrestris</i> L.	Gukhru	Zygophyllaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharja, Bhil, Damor, Dhanka	Leaves	Decoction	Kidney stone	16
	Gokhru	Zygophyllaceae	Uttar Pradesh	Kharwar, Gond, Kol, Nutt, Manjhi, Mawasi	Whole plant	Decoction	Kidney stone	20
<i>Tridax procumbens</i> L.	Molymehndi	Asteraceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharja, Bhil, Damor, Dhanka	Leaves	Paste	Kidney stone	16
<i>Trigonella emodi</i> Benth.	Hbu-su-hang, Himalayan fenugreek	Fabaceae	Ladakh	Balti, Brokpa	Leaves	Decoction	Kidney disorders	12
<i>Tubiflora acaulis</i> (L.f.) Kuntze	Patta chatta	Acanthaceae	Rajasthan	Garasia, Kathodi, Naikara, Patelia, Meena, Seharja, Bhil, Damor, Dhanka	Leaves	Powder	Kidney stone, Urinary tract troubles	16
<i>Valeriana wallichii</i> DC.	Tagar	Caprifoliaceae	Uttarakhand	Bhotia	Root, Leaves	Extract	Urinary disorders	23
<i>Withania somnifera</i> (L.) Dunal	Ashwagandha	Solanaceae	Uttarakhand	Jaunsari	Root, Leaves	Juice, Powder	Urinary disorders	14, 23



*Bergenia ciliata* (Haw.) Sternb. is a perennial herb found between the height of 800–3000 m throughout the temperate Himalayas. It is known as *Amabhedaka* in Sanskrit and has been commonly called Pakhanabheda, Silphara, Patharcua, Pakhanabhed, or hairy *Bergenia*. It is frequently used as a tonic, astringent, antiscorbutic, laxative, spleen enlargement, dysuria, and ulcers in the Ayurvedic medical system. Additionally, it has been used to dissolve kidney and bladder stones as well as to treat piles, leucorrhea, and lung infections [21,22,34]. The hydro-alcoholic extract (30:70, v/v) of *B. ciliata* rhizomes was significantly more effective in inhibiting the nucleation and aggregation of COM (CaOx monohydrate) crystals in a dose-dependent manner than Cystone. Moreover, the extract induced more CaOx (calcium oxalate) dihydrate crystals, with a significant reduction in the number and size of COM crystals, in vitro. At 10 mg/mL, the tract showed 92 and 97% nucleation and aggregation of COM crystallization than that of Cystone which is 62 and 77%, respectively at the same concentration [35]. In another study, isolated crude phenolic compounds from the leaves of *B. ciliata* showed dissolution of both calcium oxalate and phosphate stones. Moreover, alcoholic extract, butanol & ethyl acetate fractions also do the same [36].

Moreover, *Chenopodium album* L. (family: Chenopodiaceae) is a herbaceous vegetable plant locally known as Bathua. The leaves of *C. album* are used in ethno-medicinal practices for the treatment of kidney diseases and urinary stones. The aqueous extract of leaves significantly inhibited the nucleation and aggregation of CaOx crystallization and decreased the crystal density. It also inhibited the growth and caused the dissolution of brushite crystals [37]. Furthermore, the methanol or aqueous extract of leaves of *C. album* significantly attenuated the ethylene glycol-induced elevations in the urine and plasma levels of calcium, phosphorus, urea, uric acid, and creatinine along with a decrease in urine volume, pH, and oxalates. It also decreased renal tissue oxalate and deposition of oxalate crystals in the kidney [38]. Similarly, the acute treatment with crude extract (1-50 mg/kg) and its aqueous (1-25 mg/kg), n-butanol (1-50 mg/kg), and dichloromethane (1-80 mg/kg) fractions of *Asphodelus tenuifolius* exhibited significant ( $p < 0.001$ ) diuretic potential in anesthetized normotensive rats. Treatment with atropine significantly reduced the diuretic action of aqueous fraction, but pre-treatment with indomethacin or L-NAME did not affect these effects. Moreover, 7-day treatment with aqueous fraction did not reduce activities of serum angiotensin-converting enzyme, erythrocyte carbonic anhydrase, and renal Na<sup>+</sup>/K<sup>+</sup>/ATPase [39]. In another study, the aqueous extract (185 mg/kg) prepared by maceration followed by decoction and dichloromethane fraction (7 mg/kg) from dried and powdered rhizome of *B. ligulata* resulted in a substantial ( $p < 0.05$ ) drop in serum and urine indicators towards ethylene glycol-induced rats. Histological analysis revealed a smaller amount of calcium oxalate deposits and minimal injury in both extract and fraction-treated rat kidneys [40].

Likewise, when rats with ethylene glycol-induced lithiasis were given an alcoholic extract (250 & 500 mg/kg) from *Betula utilis*, all of the elevated biochemical parameters (calcium, phosphate, oxalate, creatinine, blood urea nitrogen, and uric acid) were significantly reduced, the urine pH was restored and, the urine volume increased significantly ( $p < 0.05$ ) [41]. Additionally, chlorpyrifos (CPF; 10mg/kg) caused inflammation in renal tissue, as evidenced by increased production of tumor necrosis factor-alpha and interleukin-1, as well as stimulation of inducible nitric oxide synthase. CPF also caused cell death by decreasing Bcl-2 levels and, increased Bax & caspase-3 levels. Although, methanolic extract (100, 200 & 300mg/kg) of *Beta vulgaris* root was administered an hour before CPF treatment to reduce the effects of CPF alone on renal damage in rats [42].

In another study, the ethanolic extract of *Cucumis sativus* pulp (100, 250 & 500 mg/kg) caused a dose-dependent restoration of kidney architecture and renal functions when compared to untreated alloxan group with severe renal architecture distortions and higher than normal serum urea and creatinine levels. Furthermore, the extract

improved alloxan-induced diabetic nephropathy in adult male Wistar rats in a dose-dependent manner [43]. Further, the cisplatin (CIS; 5.5 mg/kg)-treated group's total kidney tissue showed an increase in Bowman's capsule dilatation, medullar congestion, and collecting tubule dilatation, as well as a decrease in body and kidney weight. Following 4 days of therapy with hydroalcoholic extract (100, 300 & 500 mg/kg; i.p.) of *Tribulus terrestris* fruits in male mice with cisplatin-induced renal tissue damage, all measured parameters reverted to normal [44].

Following acute kidney injury generated by reperfusion injury in rats, oral treatment of ethanol extract (11 mg/kg) from *Tribulus terrestris* aerial parts for 2 weeks reduced kidney functional disruption, oxidative stress, and cellular damage [45]. Similarly, the aqueous and methanol extracts of *Tinospora sinensis* flowers (150 & 300 mg/kg; p.o.) significantly increased urine volume when compared to the control group. Both extracts increased sodium excretion, but only the aqueous extract (300 mg/kg) enhanced potassium excretion. There was no significant change observed in urine conductivity or pH after treatment of both extracts. Both extracts also exert diuretic effects similar to that of conventional medication Furosemide (20 mg/kg, p.o.) [46].

Further, the alcoholic extract (500 mg/kg; p.o.) from *Withania somnifera* roots significantly ( $p < 0.05$ ) improved renal function in gentamicin-induced nephrotoxicity while, also lowering blood urea nitrogen, creatine, alkaline phosphatase, gamma-glutamyl transferase, albumin, total protein, calcium, potassium and kidney malondialdehyde levels. The extract significantly boosted glutathione and superoxide dismutase antioxidant activities in Wistar rats to protect renal tissue from gentamicin-induced damage [47].

## CONCLUSION

Urological disorders are a major concern throughout the world. The Northern region of India is home to various plant species that are utilized to cure a variety of urological problems. A total of 103 plants have been reported to be used against urological disorders by 36 tribes throughout Jammu and Kashmir, Himachal Pradesh, Ladakh, Rajasthan, Uttarakhand, and Uttar Pradesh. A majority of tribal people in the study area use the *Bergenia ciliata*, *Artemisia*, *Bergenia*, and *Sida* genera. Despite this, many ethnomedicinal plants lack proper documentation and scientific validation. Therefore, these plant species have a basis to be investigated by modern scientific methods for the possible discovery of pharmacological activities and novel phytoconstituents. To establish the long-term clinical efficacy of these plant species, randomized controlled trials should be conducted on doses in these species.

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## Author Contribution

Conceptualization: AB; Formal analysis: SN and HS; Supervision: VA; Writing - original draft: SN and HS; review & editing: NS and DS.

### Conflict of interest

The authors declared no conflict of interest.

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### REFERENCES

1. Öztürk R, & Murt A, Epidemiology of urological infections: a global burden. *World J Urol.* 2020;38:2669-79.
2. Yang X, Chen H, Zheng Y, Qu S, Wang H, & Yi F, Disease burden and long-term trends of urinary tract infections: A worldwide report. *Front Public Health.* 2022;10:888205.
3. Singh S, Gupta S, Mishra T, Banerjee B D, & Sharma T, Risk Factors of Incident Kidney Stones in Indian Adults: A Hospital-Based Cross-Sectional Study. *Cureus.* 2023;15(2):e35558.
4. Jain SK. Ethnobotany and research on medicinal plants in India. In *Ciba Foundation Symposium 185-Ethnobotany and the Search for New Drugs: Ethnobotany and the Search for New Drugs: Ciba Foundation Symposium.* 2007;185 (pp. 153-168). Chichester, UK: John Wiley & Sons, Ltd.
5. Sen T, Samanta SK. Medicinal plants, human health and biodiversity: a broad review. *Biotechnological applications of biodiversity.* 2015:59-110.
6. Balkrishna A, Nag S, Dabas A, Arya V. Analgesic potential of medicinal plants used by the tribes of Western Himalayan region of India: A systematic review. *Medicinal Plants-International Journal of Phytomedicines and Related Industries.* 2022;14(3):382-404.
7. Singh KN, Lal B. Ethnomedicines used against four common ailments by the tribal communities of Lahaul-Spiti in western Himalaya. *Journal of ethnopharmacology.* 2008;115(1):147-59.
8. Confederation of Indian Industry. Northern India:Heralding the next chapter of growth and development. 2014. <https://assets.kpmg/content/dam/kpmg/pdf/2014/10/Northern-India-Heralding.pdf>
9. Ministry of Tribal Affairs, Government of India. 2011. <https://tribal.nic.in/Statistics.aspx>
10. Ballabh B, Chaurasia OP, Ahmed Z, Singh SB. Traditional medicinal plants of cold desert Ladakh—used against kidney and urinary disorders. *Journal of ethnopharmacology.* 2008;118(2):331-9.
11. Thakur M, Asrani RK, Thakur S, Sharma PK, Patil RD, Lal B, Parkash O. Observations on traditional usage of ethnomedicinal plants in humans and animals of Kangra and Chamba districts of Himachal Pradesh in North-Western Himalaya, India. *Journal of ethnopharmacology.* 2016;191:280-300.
12. Haq SM, Yaqoob U, Calixto ES, Rahman IU, Hashem A, Abd\_Allah EF, Alakeel MA, Alqarawi AA, Abdalla M, Hassan M, Bussmann RW. Plant resources utilization among different ethnic groups of Ladakh in Trans-Himalayan Region. *Biology.* 2021;10(9):827.
13. Phondani PC, Maikhuri RK, Rawat LS, Farooquee NA, Kala CP, Vishvakarma SR, Rao KS, Saxena KG. Ethnobotanical uses of plants among the Bhotiya tribal communities of Niti Valley in Central Himalaya, India. *Ethnobotany Research and Applications.* 2010;8:233-44.
14. Prakash R. Medicinal plants used by tribal communities: A study of Uttarakhand Himalayan region. *Int J Humanit Soc Sci Invent.* 2015;4(2):55-61.
15. Lata M. Ethnopharmacological studies on the medicinal plants used by semipastoral gujjar tribe in hills of Shikari Devi of Tehsil Thunag, District Mandi Himachal Pradesh. *J. pharmacogn. phytochem.* 2020;9(6S):402-408.
16. Sharma N, Tanwer BS, Vijayvergia R. Study of medicinal plants in Aravali regions of Rajasthan for treatment of kidney stone and urinary tract troubles. *International Journal of PharmTech Research.* 2011;3(1):110-3.
17. Katewa SS, Jain A, Chaudhary BL, Galav P. Some unreported medicinal uses of plants from the tribal area of Southern Rajasthan. *Nelumbo.* 2005:121-30.
18. Kumar G, Duggal S. Ethnobotanical wisdom among the Kiratas and Hindu-Gujjar tribes in Dharampur region of Mandi district, Himachal Pradesh,(India). *InBiol Forum Int J.* 2019;11(1):156-71.
19. Singh A, Singh GS, Singh PK. Medico-ethnobotanical inventory of Renukoot forest division of district Sonbhadra, Uttar Pradesh, India. *Ind J Nat Prod Res.* 2012;3(3):448-57.
20. Singh A, Singh P, Singh G, Pandey AK. Plant used in primary health practices in Vindhya region of eastern Uttar Pradesh, India. *Int J Herb Med.* 2014;2(2):31-37.
21. Bhat MN, Singh B, Surmal O, Singh B, Shivgotra V, Musarella CM. Ethnobotany of the Himalayas: Safeguarding medical practices and traditional uses of Kashmir regions. *Biology.* 2021;10(9):851.
22. Haq SM, Hassan M, Bussmann RW, Calixto ES, Rahman IU, Sakhi S, Ijaz F, Hashem A, Al-Arjani AB, Almutairi KF, Abd\_Allah EF. A cross-cultural analysis of plant resources among five ethnic groups in the Western Himalayan region of Jammu and Kashmir. *Biology.* 2022;11(4):491.
23. Singh B. *Plants for Novel Drug Molecules: Ethnobotany to Ethnopharmacology.* New India Publishing Agency; 2020.
24. Rana D, Bhatt A, Lal B. Ethnobotanical knowledge among the semi-pastoral Gujjar tribe in the high altitude (Adhwari's) of Churah subdivision, district Chamba, Western Himalaya. *Journal of ethnobiology and ethnomedicine.* 2019;15:1-21.
25. Rani S, Rana JC, Rana PK. Ethnomedicinal plants of Chamba district, Himachal Pradesh, India. *Journal of Medicinal Plants Research.* 2013;7(42):3147-57.
26. Singh AK, Raghubanshi AS, Singh JS. Medical ethnobotany of the tribals of Sonaghati of Sonbhadra district, Uttar Pradesh, India. *Journal of ethnopharmacology.* 2002;81(1):31-41.
27. Bhatt D, Kumar R, Joshi G, Tewari L. Indigenous uses of medicinal plants by the Vanraji tribes of Kumaun Himalaya, India. *J Med Plant Res.* 2013;7(37):2747-54.
28. Lohar M, Arora A. Ethno-functional food studies of non-commercial fruits used by Tribals of southern Rajasthan India. *Journal of Pharmacognosy and Phytochemistry.* 2019;8(1):2626-30.
29. Shah A, Bharati KA, Ahmad J, Sharma MP. New ethnomedicinal claims from Gujjar and Bakerwals tribes of Rajouri and Poonch districts of Jammu and Kashmir, India. *Journal of ethnopharmacology.* 2015;166:119-28.
30. Ishtiyak P, Hussain SA. Traditional use of medicinal plants among tribal communities of Bangus Valley, Kashmir Himalaya, India. *Studies on Ethno-Medicine.* 2017;11(4):318-31.
31. Joshi B, Pant S C, Ethnobotanical study of some common plants used among the tribal communities of Kashipur, Uttarakhand. *Indian J Nat Prod Resour.* 2012;3(2):262-66.
32. Supriya K, Chauhan K, Sagar A. Survey of ethnobotanical medicinal plants used by Gaddi tribal community in village Bandi district Kangra, Himachal Pradesh (India). *International Journal of Science and Research.* 2022;11(1):622-8.
33. Sukumaran S, Sujin RM, Geetha VS, Jeeva S. Ethnobotanical study of medicinal plants used by the Kani tribes of Pechiparai Hills, Western Ghats, India. *Acta Ecologica Sinica.* 2021;41(5):365-76.
34. Ahmad M, Butt MA, Zhang G, Sultana S, Tariq A, Zafar M. *Bergenia ciliata*: a comprehensive review of its traditional uses, phytochemistry, pharmacology and safety. *Biomedicine & Pharmacotherapy.* 2018;97:708-21.

35. Saha S, Verma RJ. Inhibition of calcium oxalate crystallisation in vitro by an extract of *Bergenia ciliata*. Arab journal of urology. 2013;11(2):187-92.
36. Byahatti VV, Pai KV, D'Souza MG. Effect of phenolic compounds from *Bergenia ciliata* (Haw.) Sternb. leaves on experimental kidney stones. Ancient science of life. 2010;30(1):14-7.
37. Sharma D, Dey YN, Sikarwar I, Sijoria R, Wanjari MM, Jadhav AD. In vitro study of aqueous leaf extract of *Chenopodium album* for inhibition of calcium oxalate and brushite crystallization. Egyptian journal of basic and applied sciences. 2016;3(2):164-71.
38. Sikarwar I, Dey YN, Wanjari MM, Sharma A, Gaidhani SN, Jadhav AD. *Chenopodium album* Linn. leaves prevent ethylene glycol-induced urolithiasis in rats. Journal of ethnopharmacology. 2017;195:275-82.
39. Younis W, Alamgeer, Schini-Kerth VB, Nocchi SR, Silva DB, de Souza P et al. Involvement of Muscarinic Receptors in Hypotensive and Diuretic Effects of Aqueous Soluble Fraction from *Asphodelus tenuifolius* Cav. Evidence-Based Complementary and Alternative Medicine. 2021;2021(1):6653270.
40. Sharma I, Khan W, Parveen R, Alam MJ, Ahmad I, Ansari MH, Ahmad S. Antiurolithiasis activity of bioactivity guided fraction of *Bergenia ligulata* against ethylene glycol induced renal calculi in rat. BioMed Research International. 2017;2017(1):1969525.
41. Shah SK, Patel KM, Vaviya PM. Evaluation of antiurolithiatic activity of *Betula utilis* in rats using ethylene glycol model. Asian Journal of Pharmaceutical Research. 2017;7(2):81-7.
42. Albasher G, Almeer R, Alarifi S, Alkhtani S, Farhood M, Al-Otibi FO et al. Nephroprotective Role of *Beta vulgaris* L. Root Extract against Chlorpyrifos-Induced Renal Injury in Rats. Evidence-Based Complementary and Alternative Medicine. 2019;2019(1):3595761.
43. Ofoego UC, Nweke EO, Nzube OM. Ameliorative Effect of Ethanolic Extract of *Cucumis Sativus* (Cucumber) Pulp on Alloxan Induced Kidney Toxicity in Male Adult Wistar Rats Ameliorative Effect of Ethanolic Extract of *Cucumis Sativus* (Cucumber) Pulp on Alloxan Induced Kidney Toxicity. J Nat Sci Res. 2020;9:12-22.
44. Raoofi A, Khazaei M, Ghanbari A. Protective effect of hydroalcoholic extract of *Tribulus terrestris* on cisplatin induced renal tissue damage in male mice. International Journal of Preventive Medicine. 2015;6:11.
45. Najafi H, Firouzifar MR, Shafaat O, Ashtiyani SC, Hosseini N. Protective effects of *Tribulus terrestris* L extract against acute kidney injury induced by reperfusion injury in rats. Iranian journal of kidney diseases. 2014;8(4):292.
46. Rao AS, Sastry VG, Chandrakanth B, Prasad BD, Devial J. Evaluation of diuretic activity of aqueous and methanol extracts of *tinospira sinensis* in rats. Acta Biomedica Scientia. 2014;1(2):58-60.
47. Govindappa PK, Gautam V, Tripathi SM, Sahni YP, Raghavendra HL. Effect of *Withania somnifera* on gentamicin induced renal lesions in rats. Revista Brasileira de Farmacognosia. 2019;29(2):234-40.

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