

Ethnobotanical Uses of Some Medicinal Plants Employed by Local Peoples of Samastipur District, Bihar, India

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Abstract

Samastipur district of Bihar has biodiversity less in medicinal plant species. It consists of various medicinal plants with high medicinal values. This research through an ethnobotanical survey of medicinal plant species in the district of Samastipur Bihar and traditional knowledge continuity, assesses traditional medicinal plant familiarity and identifies vital regional treatments and their therapeutic uses. In the field, we collected ethnobotanical data using different methods, like free listings, key informant interviews, and semi-structured interviews of locals. From different blocks of the Samastipur district, many local informants were involved in interviews and questionnaire distribution. To gauge the importance of medicinal plant species. A total of 38 medicinal plants were documented and reported in the study. Local names, therapeutic uses, parts used, and the relationship between ailments of medicinal plant species are presented. The most encountered medicinal plant families were fabaceae, Cyperaceae, Apiaceae, Poaceae, Convolvulaceae, Trapaceae, Asteraceae, etc. In Samastipur district, the healing traditions of medicinal plant species are vital for healthcare, emphasizing the importance of preserving indigenous knowledge for sustainable resource use. More research is essential to gain a deeper understanding of local perspectives.

Keywords: Biodiversity, Ethnobotanical, Indigenous knowledge, Medicinal plants, Samastipur

INTRODUCTION

Samastipur is one of the thirty-eight districts of Bihar in India. The district headquarters are located at Samastipur. Samastipur district occupies an area of 2,904 square kilometers (1,121sq mi), comparatively equivalent to Indonesia's Muna island Samastipur is bounded on the north by the Bagmati River which separates it from the Darbhanga district on the west it is boarded by the Vaishali district and some part of Muzaffarpur district, on the south by the Ganges, while on its east it has Begusarai and some part of Khagaria district. Samastipur is traversed by several rivers including Budhi Gandak, Baya, Kosi, Kamla, Kareh Jhamwari, and Balan, which are both the offshoots of Burhi Gandak.

The Ganges also skirts the district on the south. India is a country with a highly diverse ecosystem, recognized as one of the world's top 12 mega-diversity nations. Our herbal wealth constitutes more than 8,000 species (Lakshman, 2016). More than 70% of India's 1.1 billion population primarily rely on traditional medicines of herbal origin for primary healthcare and practices and still use these non-allopathic systems of medicine. Indian medicinal plants provide a rich source of antioxidants that are known to prevent/delay different health diseases. The rural/tribal Indian peoples have good knowledge about the uses of medicinal plants from the prehistoric period (Singh, 2010) and they prefer these plants due to their easy availability and cheap therapy as compared to costly allopathic medicines/ drugs as well as having no/least side effects and broad-spectrum medicinal potency (Rupani and Chavez 2018). Traditional medicines (TMs) of plant origin have been used for the management of different human diseases (HD); diabetes, skin treatment, Stomach disease, Asthma, cough, Fever, Breast pain, jaundice, etc.

The benefit of Ethnobotanical explorations has increased recently at the national and international levels. The literature review reveals that there is still a huge gap in knowledge of ethnomedicine and its scientific validation. Traditional use of plants and plant parts has been a deep-rooted practical knowledge in the traditional and modern social practices and livelihood of the people living in the remote parts of the world. They used these different medicinal plants in their daily healthcare practices. The Medico-Ethano Botanical survey (MEBS) acts as the correlation linking between ethnobotany and tribal knowledge regarding the medicinal properties of the plants. The plant-based knowledge has become a known factor in exploring novel sources of medicines. Knowledge about medicinal plants has also been descended

through generations and has survived through time. Knowledge of Ayurveda has been passed through the Guru-Shishya tradition or from father to son.

Bihar supports the bio-diversity richness and facilitates the high species richness of medicinal plants in accordance with the different agro-climatic zone (Ambasta et al., 2016). This plant-based traditional knowledge has become a recognized tool in the search for new sources of drugs and nutraceuticals (Sharma and Mujumdar, 2003). There are a few literature and survey reports in Bihar that reveal the practice of herbal medicine for primary health treatments (Pratik et al., 2020; Singh et al., 2020). They collect and preserve locally available, wild, and cultivated plant species. Tiwari et al. (2012) surveyed three districts Bhagalpur, Banka (Bihar), and Dumka (Jharkhand) to document the medicinal plants in wasteland areas. A total of 68 medicinal plants are recorded which are being used by the local population for curing diseases. However, these plants are not cultivated for commercial use.

In this present Research, survey the therapeutic use of medicinal plants among local/rural people of the Samastipur district of Bihar, as well as to check the recent status of the medicinal plants in this area through an intensive survey. A preliminary survey of villages around Samastipur town of Bihar revealed that local communities residing in this region are still practicing herbal medicine extensively in their primary health care. Hence, an attempt has been made to document plant species, medicinal formulations, and treatment of particular diseases by communities residing in this area. Therefore, this study is undertaken to ascertain the detailed ethnobotanical inventory of medicinal plants of the Samastipur district, Bihar, and their therapeutic usage by local people based on ethnobotanical knowledge. This study will help in understanding the sustainable utilization of available plant resources for primary healthcare and further clinical trial.

In India and around the world, several works have been undertaken to explore the ethnobotanical values of medicinal plants and their therapeutic applications by the folk population. Between 60%-70% of populations in developing countries living in agricultural and forest areas collect various plant parts and foods from the forest species such as roots, leaves, fruits, and nuts which form an integral part of their daily diets (Jeyaprakash et al., 2011). In Nepal, about 90% of the population resides in rural areas where access to government healthcare facilities is lacking (Singh et al., 2012).

All the ethnic communities have their own pool of secret ethnomedicinal and ethnopharmacological knowledge about the plants available in their surroundings, which has been serving rural people with its superiority. Indian people are using medicinal plants since the prehistoric period. Tribal, living mostly in remote forest areas, still depend to a great extent on the indigenous system of medicine. Indigenous healing practices have been culturally accepted during all phases of human culture and environmental evolution (Singh et al., 2022). Bose et al. (2015) from West Bengal studied on therapeutic applications of about 115 plant species belonging to families of Piperaceae, Asteraceae, Verbenaceae, and others.

Information on 37 anti-fertility plants belonging to 26 families used by ethnic communities of three districts of Assam was reported by Choudhury et al. (2012). Some reports are also available documenting in Bihar documenting the ethnobotanical flora of Bihar and its therapeutic uses (Pratik et al., 2020; Singh et al., 2020; Tiwari et al., 2012). The diversity of Samastipur are source of important aquatic, semiaquatic and terrestrial medicinal plants. In this investigation, I am attempting to document some ethnobotanical plants and the traditional knowledge before their extinction.

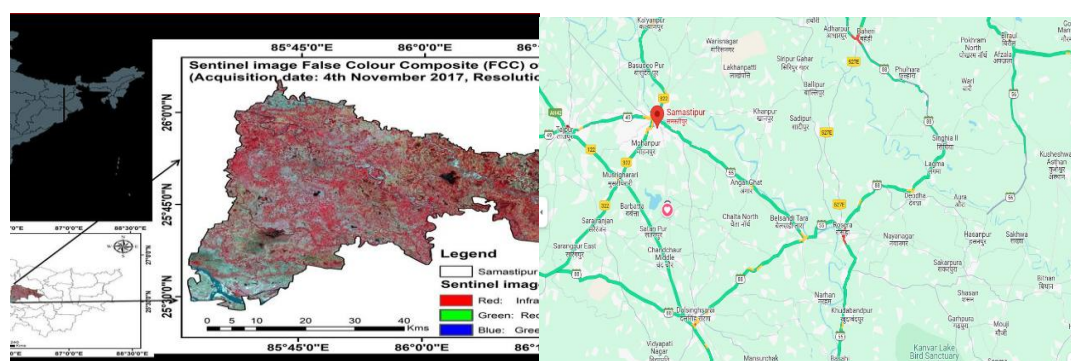


Fig: 3 Map of Samastipur district

METHODOLOGY

Medicinal plants were collected through a survey based on field observations. From October 2023 to September 2024, several field trips to different parts of the district of Samastipur were conducted to collect plant samples. Traditional medicine practitioners, vaidyas, prists, sanyasis, and locals were interviewed to know the medicinal importance of these plants. The data collected is based on first-hand information. The plants were collected for identification and herbarium preparation. The plants were preserved after every collection (Bibi et al., 2014). The plants were dried and properly mounted on standard-size (16½ × 12½) rough papers and blotting papers till they become completely dry. The preserved plants were poisoned with 1% HgCl₂ solution in rectified spirit and stored carefully. Naphthalene balls and periodical fumigation with formaldehyde was used as repellent for keeping herbarium sheets in Herbarium Elmira's. Fevicol was used as pasting material. The plants are identified after studying all the character and comparing them with available standard flora and other taxonomic literature on the medicinal plants. "The Botany of Bihar and Orissa" Vol I, II & Vol III (Hains 1921-1925) and Flora of Bihar, Analysis (Singh et al., 2001). Some of the plant specimens which could not be identified up to the species level will be later confirmed by experts and compared with the literature and thesis available in the P.G. Botany Departmental Library, University Library, B.R.A Bihar, Muzaffarpur.

During the identification, the morphological characters such as habit, habitat, stem, leaves, flowers, inflorescence, calyx, corolla, stamens, anthers, carpels, ovary, ovules, fruit, seed, and cotyledons will be taken into consideration for easy identification.

Table 1: List of ethnobotanical medicinal plants with their medicinal values

S.no.	Botanical name	Family name	Local name	Plant parts used	Therapeutic use of plants
1	Acorus calamus	Araceae	Bach	Dried rhizome, leaf	Leaf extract is used in dysentery and stomach ache, roots are used for cough and cold.
2	Anacyclus pyrethrum	Asteraceae	Akarkara	Root	Roots are used in Dental Health, Anti-inflammatory, Analgesic and Digestive Health
3	Ananas comosus	Bromeliaceae	Ananas	fruit, stem, and leaves	It is used in Digestive Aid, Anti-inflammatory, Wound Healing, Antioxidant, Respiratory Health, Weight Loss, Blood Pressure Regulation
4	Andrographis paniculata	Acanthaceae	Kalmegh	Whole plant	Kalmegh is used as a liver tonic, to treat infections, and to reduce fever. It is also an anti-inflammatory and immune-boosting herb.
5	Azadirachta indica	Meliaceae	Neem	Leaves, Bark, Seeds	Neem is used to treat skin diseases, improve dental health, and reduce fever. It has antimicrobial, anti-inflammatory, and antifungal properties
6	Bacopa monnieri (L.) Pannell	Scrophulariaceae	Brahmi	Whole plant	Heart disease curing, Skin Health, Respiratory Health, Pain Relief, Epilepsy and Seizures
7	Cajanus cajan	Fabaceae	Arhar	Seeds, Leaves, Roots, Flowers	Used in Anti-inflammatory, Antioxidant, Antimicrobial, Digestive Health, Blood Sugar Regulation, Wound Healing, Anti-cancer
8	Centella asiatica	Apiaceae	Brahmni buti	Whole plant	Used in dysentery and healing of wounds
9	Ceratophyllum demersum	Ceratophyllaceae	Sivara	Leaf shoot	Leaf juice is used in vomiting and is also used as a cooling agent

10	Cinnamomum tamala	Lauraceae	tejpatta	Leaves	Tejpatta is used for treating digestive issues, reducing inflammation, and improving circulation. It has antioxidant, anti-inflammatory, and digestive properties
11	Clitoria ternatea	Fabaceae	Aprajita	Flowers, Leaves, Roots	Used in Cognitive Health, Anti-anxiety & Sedative, Anti-inflammatory, Antioxidant, Antidepressant, Hair Health, Skin Health, Eye Health, Anti-diabetic, Pain Relief
12	Colocasia esculenta	Araceae	Arui	Root, Leaves, Stem	Used in Digestive Health, Anti-inflammatory, Skin Health, Wound Healing, Antioxidant, Detoxification, Anti-cancer
13	Commelina benghalensis	Commelinaceae	Kanchara	Leaf shoot, stem	Stem and leaf paste is used in bone fracture
14	Cuscuta reflexa	Cuscutaceae	Amarbel	Whole plant	Used as Anti-inflammatory, Antioxidant, Immunity Booster, Skin Disorders, Anti-microbial, Fertility & Reproductive Health, Hepatoprotective, Kidney Health, Anti-cancer, Anti-diabetic
15	Cyperus rotundus	Cyperaceae	Motha	Rhizome	Tuber paste is used in appetizer
16	Cyperus scariosus	Cyperaceae	Galmotha	Rhizome	Tubers are used for skin disease
17	Echhornia crassipes	Pontederiaceae	Water hyacinth	Whole plant	The extract is used in the treatment of skin disease in horses
18	Heliotropium indicum	Boraginaceae	Hathi Sunda	Leaves	Leaf extract is used in insect bites
19	Imperata cylindrica	Poaceae	Dabh	Roots	Used in fever curing
20	Ipomoea aquatica	Convolvulaceae	Karmi	Whole plant	Leaf extract is used in preventing bleeding
21	Lindernia crustacea	Scrophulariaceae	Kashidori	Whole plant	Used in dysentery and worm infection
22	Linum usitatissimum	Linaceae	Tisi	Seeds, Stem	Used in Digestive Health, Cardiovascular Health, Anti-inflammatory, Antioxidant, Skin Health, Hormonal Balance, Blood Sugar Regulation, Cancer Prevention
23	Monochorea hastata	Pontederiaceae	Bipat	Whole plant	Plant extract is used in stomach ache
24	Moringa oleifera	Moringaceae	Moringa	Leaves, seeds	Moringa is used for treating malnutrition, improving digestion, and reducing inflammation. It has anti-inflammatory, antioxidant, and anti-diabetic properties
25	Nelumbo nucifera	Nelumbonaceae	Kamal	Seed, fruits, leaves	Seeds are used by children, fruits in used heart disease, boosting the immune system

26	Nymphaea nouchalibrum	Nymphaeaceae	Bagbhat	Fruits & seeds	A flower are eaten fried, seeds are also eaten raw by children, diabetes, swelling, hepatic diseases, kidney problems, and menstruation
27	Ocimum sanctum	Lamiaceae	Tulsi	Leaves	Tulsi is used for improving immunity, treating respiratory issues, and reducing stress. It has antimicrobial, adaptogenic, and anti-inflammatory properties.
28	Polygonum glabrum	Polygonaceae	Pani-mirch	Roots and leaves	Crushed leaves are taken in pneumonia
29	Psidium guajava	Myrtaceae	Amrood	Fruit, Leaves, Bark, Roots	Used in skin health, Digestive Health, Anti-inflammatory, Antioxidant, Blood Sugar Regulation, Anti-microbial, Heart Health, Diarrhea and Dysentery, Anti-cancer
30	Punica granatum	Punicaceae	Anar	Fruit, Leaves, Bark	It is used as Antioxidant, Heart Health, Anti-inflammatory, Anti-cancer, Skin Health, Digestive Health, Antimicrobial, Urinary Health, Boosting Immunity, Anti-depressant
31	Saraca asoca	Fabaceae	Ashoka	Bark & flowers	Ashoka is used for treating menstrual disorders, reducing inflammation, and improving skin health. It has anti-inflammatory, astringent, and antispasmodic properties
32	Sesbania grandiflora	Fabaceae	Agast	Flowers, Leaves, Seeds, Roots	It is used as Anti-inflammatory, Antioxidant, Diuretic, Anti-diabetic, Liver Health, Antimicrobial, Respiratory Health, Skin Health, Digestive Health, Anti-cancer, Blood Pressure Regulation
33	Solanum indicum	Solanaceae	Poison berry	seed	Seed applied on teeth and gum to treat infection
34	Spondias pinnata	Anacardiaceae	Amra	Fruit, Leaves, Bark, Flowers, Seeds	it is used in Digestive Health, Anti-inflammatory, Antioxidant, Anti-microbial, Skin Health, Blood Sugar Regulation, Diuretic, Hepatoprotective, Anti-cancer, Anti-fungal, Anti-hemorrhoidal
35	Trachyspermum ammi	Boraginaceae	Andhpusti	Seeds, Leaves, Roots	it is used in Digestive Health, Anti-inflammatory, Antimicrobial, Pain Relief, Respiratory Health, Antioxidant, Weight Loss, Anti-cancer, Anti-spasmodic, Antidiabetic, Detoxification, Skin Health
36	Trapa natans	Trapaceae	Singhara	Fruits	Raw fruits are used in the treatment of diarrhea
37	Terminalia arjuna	Combretaceae	Arjun	Bark, Leaves, Flowers, Fruit	It is used in Cardiovascular Health, Anti-hypertensive, Anti-inflammatory, Antioxidant, Liver Health, Wound Healing, Cholesterol Management, Stress and Anxiety Relief, Diuretic, Anti-diabetic, Skin Health, Anti-cancer
38	Xanthium strumarium	Asteraceae	Chota-dhathura	Seed and fruits	Seed oil is used in curing ear pain

RESULT AND DISCUSSION

Present studies revealed the occurrence of a total of 38 medicinally important species belonging to 29 families the enumeration embodies an alphabetically arranged list of the species priding correct botanical names of the species followed by local names, family names, parts used, and plant parts used in different ailments like skin including wound, bone, heart, stomach problems, etc. the Fabaceae was found to be a dominant family in terms of species in the study area with 4 species, other families were also found in this area Araceae 2, Acanthaceae 1, Anacardiaceae 1, Apiaceae 1, Asteraceae 2, Boraginaceae 2, Bromeliaceae 1, Ceratophyllaceae 1, Combretaceae 1, Commelinaceae 1, Convolvulaceae 1, Cuscutaceae 1, Cyperaceae 2, Lamiaceae 1, Lauraceae 1, Linaceae 1, Meliaceae 1, Moringaceae 1, Myrtaceae 1, Nelumbonaceae 1, Nymphaeaceae 1, Poaceae 1, Polygonaceae 1, Pontederiaceae 2, Punicaceae 1, Scrophulariaceae 2, Solanaceae 1, Trapaceae 1 were showed in fig:1

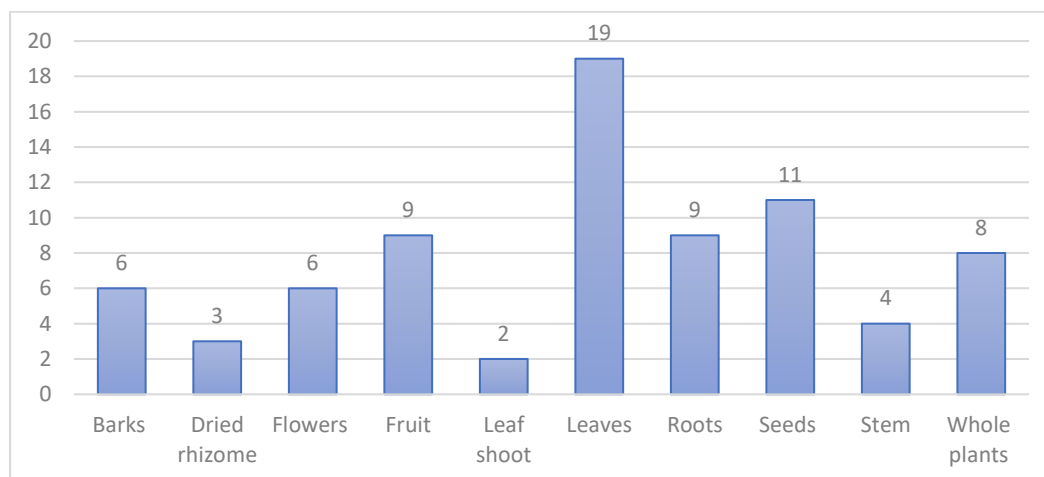
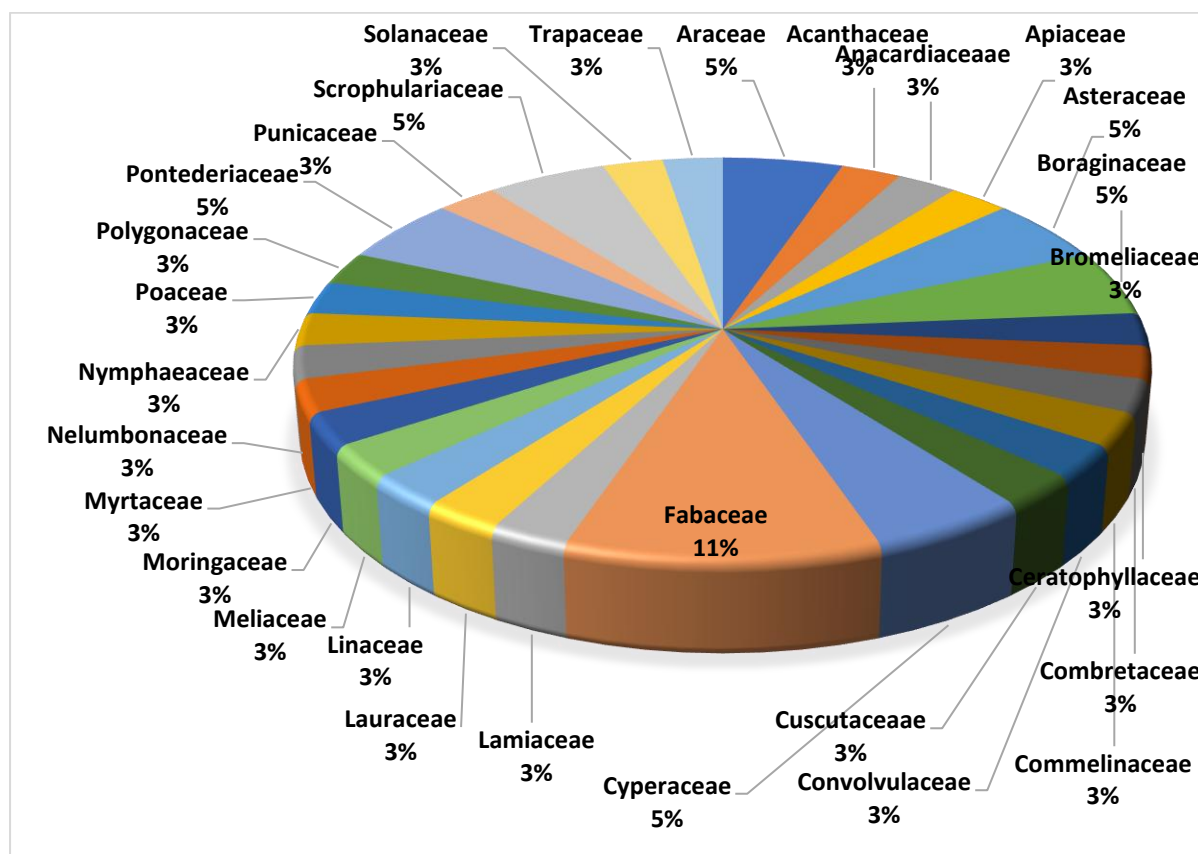


Fig: 2 The total plant parts used in the treatment of different disease



In this study of total of 38 plant species of medicinal plants and 29 families were collected from near Samastipur district. The most frequently utilized plant parts for the preparation of remedies were leaves (25%), followed by roots (12%), seeds (14%), stems (5%), whole plants (10%), barks (8%), dried rhizome (8%), flower (8%), leaf shoot (2%) and fruits (12%). All medicinal plant parts are used in different ailments and in other ways by the native people of the Samastipur district of Bihar, India.

CONCLUSION

The present study is an attempt to survey of ethnobotanical plants in district Samastipur, locating between 25.862968 and 25° 51' 46.6848" N altitude and 85.781029 and 85° 46' 51.7044" E longitude and covers about 2904 km² areas. The plants were collected with the help of farmers, grazers, villagers, and locals of Samastipur district. the information about ethnomedicinal use, local name of the plants and plant parts used, formulation, dose, duration, and mode of administration was sought from local healers and herbal practitioners like holymen, priests, vaidyas, hakims, ojhas, etc, besides village headmen, aged and knowledgeable and experienced men and women and other native peoples of Samastipur. The collected plants were matched and confirmed with the help of available regional and local floras and literature. Ethnobotanical plants were also categorized based on their affectivity against different disorders and various ailments of other systems of the human body. The native persons of Samastipur district greatly use these habitually available medicinal plants for health which are less expensive without side effects. The zone is rich in medicinal plants and these plants are still commonly used for medicinal purposes among the people in their daily routines. However, there is a gradual loss of traditional knowledge about these plants in the new generation. So it is concluded that as ethnobotanical plants are used to cure diseases in one way or the other, so there is an urgent need to make a documented record of their use. And there is also a need to promote scientific cultivation which will protect and conserve the flora of Samastipur district. Such type of researches should remain continued as they provide vital information for the future research on medicinal as well as helps in the conservation of our precious herbal wealth through the realization of the immense value of the plants by future generations. From this study, 38 species were recorded to be used by the traditional medicine practitioners and locals of the samastipur these medicinal plant remedies comparatively have certain advantages as these are easily accessible and affordable to rural communities.

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REFERENCES

1. Basani K, Mondi S, Tiwari AK (2023) Water Lily (*Nymphaea nouchali* Burm. f): An Ancient Treasure of Food and Medicine Pharmacogn. Res., 15(2):226-234. <https://www.phcogres.com>
2. Bibi T, Ahmad M, Tareen RB, Tareen NM, Jabeen R, Rehman SU, et al. Ethnobotany of medicinal plants in district Mastung of Balochistan province-Pakistan. Journal of Ethnopharmacology. 2014;157:79-89
3. Ambasta SK, Kumari S, Yadav A K, Trivedi I, Prasad B, Sinha UK (2016) Medicinal plants of Bihar and its neighbouring region which needs attention for their conservation. European Journal of Biomedical and Pharmaceutical sciences 3: 544-550.
4. Bose D, Roy GJ, Mahapatra DS, Datta T, Das S & Biswas H., 2015. Medicinal plants used by tribals in Jalpaiguri district, West Bengal, India., Journal of Medicinal Plants Studies 3(3): 15-21
5. Choudhury S, Sharma P, Choudhury DM, Sharma DG., 2012. Ethnomedicinal plants used by Chorei tribes of Southern Assam, North Eastern India., Asian Pacific Journal of Tropical Disease) S141-S147
6. Datta T, Patra AK, Dastidar SG., 2014. Medicinal plants used by tribal population of Coochbehar district, West Bengal, India-an ethnobotanical survey., Asian Pac J Trop Biomed 4 (Suppl 1): S478-S482
7. Devi Seema. 2012. Medicinal plants of district Hamirpur (H.P.). Ph.D. Thesis ch. Charan singh university, Meerut.
8. Haines, H-H (1921-25) The Botany of Bihar and Orissa: an account of all the known indigenous plants of the province and of the most important or most commonly cultivated exotic ones. Publisher Adlard and Son and West Newman, London.
9. Ibrahim S, Humaira F, Abrar M, Ali SM (2018) *Ceratophyllum demersum* a Free-floating Aquatic Plant: A Review Indian Journal of Pharmaceutical and Biological Research (IJPBR)ISSN: 2320-9267
10. Jeyaprakash k, Ayyanar M, Geetha KN, Sekar T., 2011. Traditional uses of medicinal plants among the tribal people in Theni District (Western Ghats), Southern India Asian Pacific Journal of Tropical Biomedicine S20-S25
11. Kasana B, Sharma SK, Singh L, Mohapatra S, Singh T (2013) *Cyperus scariosus*: a potential medicinal herb. International Research Journal Of Pharmacy. ISSN 2230 – 8407

12. Kumar V (2018) Medicinal plants of Sultanpur district (U.P.) India. Indian Journal of Plant Sciences ISSN: 2319-3824
13. Lal S, Laikhuram J, Moran B, Kumar S (2023) Medico Bio-wealth of India, Volume XII; ISBN: 978-81-967170-2-5
14. Lakshman CD. 2016. Bio-diversity and conservation of medicinal and aromatic plants. Adv Plants Agric Res.5(4):561-566.
15. Pratik, P., Thakur, R.V., 2020. Study of Phytochemicals, Spectroscopic Analysis and Anti-Microbial Activity of High-Value Bioactive Compound from Methanolic Extract of Flower of Tilkor (*Momoradica monadelphica*)
16. Rupani R, Chavez A (2018) Medicinal plants with traditional use: Ethnobotany in the Indian subcontinent. Clinics in Dermatology 36: 306-309
17. Sharma, P.P., Mujumdar, A.M., 2003. Traditional knowledge on plants from Toranmal Plateau of Maharashtra. Indian Journal of Traditional Knowledge 2, 292-296.
18. Singh Arvind, Singh M.K., Singh D.K., Singh Ritesh. 2013. Ethnomedicinal studies on wetland plant diversity of district Buxar (Bihar, India). Unique journal of pharmaceutical and biological sciences.
19. Singh, N.P., Mugdal V., Khanna K.K. et al (2001) Flora of Bihar, Analysis. Botanical survey of India.
20. Singh, H., Mishra, M., Dhole, P.A. (2020) Ethnomedicinal Plants Used by the Tribal Communities of West Champaran District of Bihar, India. Plantae Scientia Plantae Scientia: Volume 03, Issue 04.
21. Singh S, Guleri S, Harashwaradhana, Singh SK., 2022. Ethnobotanical traditional knowledge of communicable diseases among tribal people of Jaunsar-Bawar region of Garhwal, Uttarakhand. Rabindra Bharati Journal of Philosophy ISSN: 0973-0087
22. Soni SK, Sharma Nishi, Rani Manaswi and Singh Shubhangi., 2022. Some medicinally important plants with their uses from Yamuna River, Agra Uttar Pradesh (India). Journal of Medicinal Plants Studies
23. Swapna MM, Prakashkumar R, Anoop KP, Manju CN, Rajith NPM (2011) A review on the medicinal and edible aspects of aquatic and wetland plants of India. Journal of Medicinal Plants Research Vol. 5(33), pp. 7163-7176, 31ISSN 1996-0875
24. Tiwari SK, Sourabh P., 2012. Medicinal Plants in Wasteland areas of Bihar and Jharkhand., NeBIO I www.nebio.in I Vol. 3, No. 3, 110-114