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THERAPEUTIC NATIVE PLANTS USED BY THE COMMUNITIES OF DEEPOR BEEL WETLAND: A RAMSAR SITE OF INTERNATIONAL SIGNIFICANCE, ASSAM

[1]Priyanka Kalita, [2] Fardin Rahman Saikia
[1]Department of Zoology, Pandu College
[2]Assistant Professor (Part-time) Department of Zoology, Dakshin Kamrup College, Mirza
[1] Guwahati, India

Abstract: An ethnobotanical study was carried out among the local communities of people living in the vicinity of Deepor Beel which aimed to document the traditional knowledge of the ethnic groups. The information has been documented through interviews from different local healers and locals of the area. A total of 111 plants have been documented belonging to 51 different families which are used to treat around 29 different diseases. The most commonly medicated ailment was of abdominal dysfunctions followed by skin and hair treatment and jaundice and wound healing. Among the 56 families, the most cited family was of Fabaceae. Of these species, 32.43% were categorized as herbs, 38.7% as trees, 19.81% as shrubs, and 9% as climbers. The mostly used plant part in the treatment was the leaf whose mode of administration was mostly by direct consumption. Further phytochemical investigations need to be done to detect the potential of the drugs that can be extracted from the plants.

Index Terms **- Ethnobotany, medicinal plants, Deepor beel wetland, conservation, local healers.**

I. INTRODUCTION

Wetlands are vital ecosystems that play a crucial role in maintaining the health and balance of the environment. They are transitional zones between terrestrial and aquatic environments, characterised by the presence of water, hydric soils and unique vegetation. Thus, well-managed wetlands can support this agenda because of their potential to support livelihood opportunities in vulnerable communities regardless of size and location. The potential of wetlands to provide supportive opportunities can, however, be sustainable only when its exploitation is supported by effective wetland management measures (Rebelo L.M. *et al*., 2010). Deepor Beel wetland is a significant ecological gem nestled in the state of Assam, India and is spread over an area of about 40 square kilometers and is one of the largest beels, or wetlands, in the Brahmaputra valley. This wetland is not just a picturesque landscape but also serves as a vital habitat for a diverse range of flora and fauna. Deepor beel, Assam is a Ramsar site of international significance and a wildlife sanctuary. Ramsar Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres" (Athira K. R., 2019). India uses a wide range of medicinal plants mostly in Ayurvedic, Unani, Siddha, Homeopathic, Allopathic and other alternate medicinal practices such as folk medicine, home remedies, household remedies, naturopathy, tantra- therapy, Amchi and tribal medicines. Research indicates that tribal and ethnic communities across India incorporate over 8000 plant species and approximately 25,000 formulations based on folk medicine into their healthcare practices. More than 1.5 million traditional medical practitioners in India use medicinal plants for preventive, promotional and curative purposes. About 65% of the Indian population relies upon traditional medicine for its healthcare needs (Naveen K. Sharma, 2016). Local healers mostly treat diseases such as aches and wounds, musculoskeletal ailments and respiratory diseases. Northeastern India is rich in ethnic culture and a diverse range of plants. Its distinct geographic location, which includes a wide variety of forests ranging from tropical to alpine and contains a massive reservoir of plants, is the cause of its great floristic diversity. Only 5–8% of it is covered by ethnobotanical studies, despite its abundance of natural resources and ethnic culture. People of the neighbouring areas collect resources from the wetlands for fodder, vegetables, medicines, biofertilizers, and religious functions. Studies also reveals that approximately 800 schedule caste population depends on Deepor Beel for fishing and is the only source of livelihood. However, significantly, the diversity of fishes decreases alarmingly in the wetland due to contamination of polluted water that make wetland water unhealthy for fish survival which affected badly not only livelihood of the wetland depending communities but also the whole wetland ecosystem as well. Areas resided by tribal communities provide better knowledge and scope for ethnobotanical practices. Assam has a rich traditional knowledge of folk medicinal practices among the local traditional healers. However, rapid fragmentation of natural habitats and unrestricted exploitation coupled with limited cultivation and insufficient attempts for its replacement has reduced this knowledge day by day (Das Amar Jyoti *et al*., 2012). Because of their scattered and far-flung settlements, and problems arising due to transportation and communication, traditional medicine has remained as the most affordable and easily accessible source of treatment (Das Amar Jyoti *et al*., 2012). The integration of these macrophytes into traditional medicinal practices highlights the rich pharmacological potential that wetland ecosystems harbour. Local and regional surveys of biodiversity that include socioeconomically important plants can provide insights into the importance of wetlands as sources of medicinal plants, their contribution to health and livelihood

benefits, and their conservation challenges (Leaman, 2016). However, responsible and sustainable harvesting practices are crucial to ensure the preservation of these valuable plants and the delicate balance of wetland ecosystems. As the gap between the older and younger generation increased over the modern period of time, the traditional knowledge seems to be decreasing. Thus, it is important to keep the documentation of traditional knowledge for the future utilisation and conservation of the medicinal plants. As we explore the medicinal values of these macrophytes, it becomes evident that their significance extends beyond ecological roles to encompass the profound interconnection between nature and human well-being. Medicinal plants play a vital role in the local economy and healthcare and the demand is increasing. Many populations of medicinal plants seem to drastically decline due to overexploitation and unsustainable harvesting (Singh Ankit *et al*., 2017). The present study will primarily focus on the interactions with the communities and learning of their knowledge on medicinal values of plants of the area.

II RESEARCH METHODOLOGY

Study Site

Located in the Brahmaputra valley in lower Assam, 10 kilometers southwest of Guwahati, is Deepor Beel, one of the largest wetlands and the only Ramsar site in Assam. It is an open lake basin and riverine wetland. The beel has channels for inflow and outflow. It spans 40.14 square kilometers. It is situated at the global position at N 26° 09′26″ latitude and E 90° 45′25″ longitude. Deepor Beel is a location that is sensitive to biology and the environment. The features of the wetland bear striking similarities to the Burmese monsoon biogeographic region. The hydrophytic vegetation of the beel has been categorized into the following groups based on ecological adaptation; each group contains unique floristic components. Which are as follows: Aquatic vegetation is present throughout the summer, including huge water lilies, water hyacinth, aquatic grasses, and other submerged, emergent, and floating plants. In the dry regions, aquatic and semi-aquatic plants are visible in the winter. In deep open water locations, emergent vegetation, marshy lands, mud flats, patches of water hyacinth, and net-grass land patches have all been reported. Terrestrial avifauna, including migratory and resident waterfowl, are often found in paddy fields, arid grasslands, and remote woodland areas.

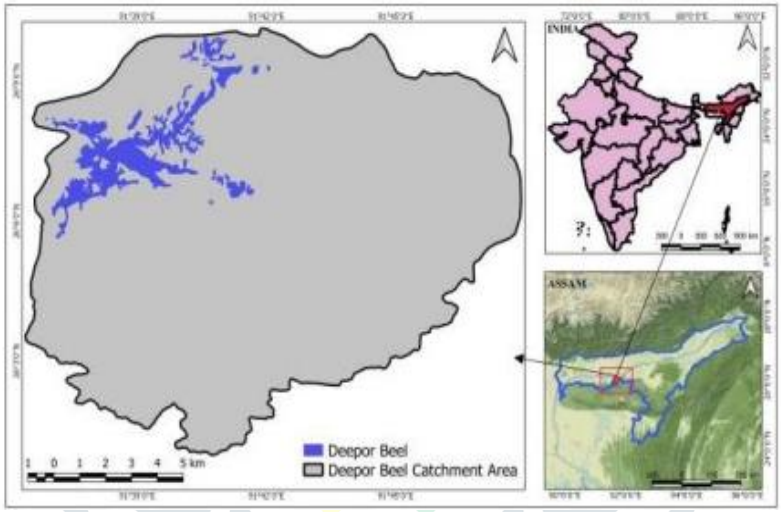

figure 1- location of study area

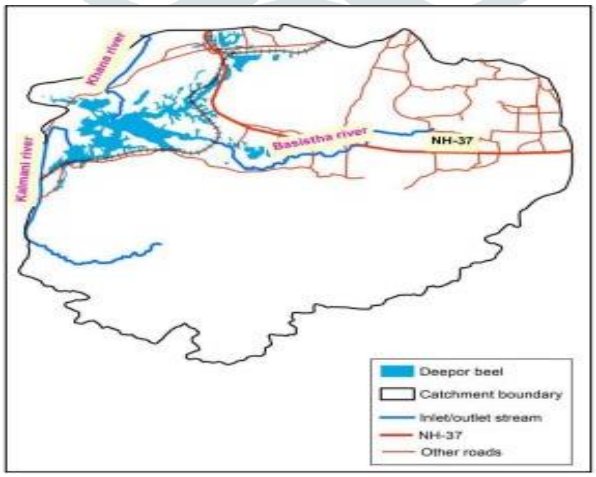

Figure 2- deepor beel and its catchment

Several Field visits were conducted intermittently from November, 2023 to April, 2024, engaging various communities residing near the wetlands surrounding Deepor Beel. These surveys aimed to gather comprehensive data on the diverse uses of plants and their ethnomedicinal values. Interviews were conducted with traditional medicine practitioners, local healers, and villagers to elucidate the medicinal significance of the flora. A structured questionnaire was prepared to ensure comprehensive documentation of the collected data from the local people which comprised of local name of the plant, part of the plant used, disease cured by the plant, the preparation and dosing procedure and side effects of the plant. Name, place of birth, age and education was also documented for future reference of the interviewee. A total of 62 villagers were

interviewed which included traditional healers as well as locals from 5 different villages surrounding Deepor Beel. High resolution photographs were clicked using a camera for future references and identification of the plant species using regional knowledge and the book- Flora of Assam by U.N Kanjilal, P.C Kanjilal and A. Das.

III. RESULTS AND DISCUSSION

In the course of this survey and investigation, data pertaining to a total of 111 plant species from 56 families (as detailed in Table 1) were meticulously gathered, documented, and authenticated. Of these species, 32.43% were categorized as herbs, 38.7% as trees, 19.81% as shrubs, and 9% as climbers. These plants were found to address around 29 different ailments, with a notable emphasis on treating abdominal issues such as stomach pain, diarrhea, constipation, flatulence, and digestive disorders. Following abdominal ailments, skin and hair treatments, as well as remedies for jaundice, were commonly cited uses.

Given the high engagement of rural populations in activities like wood and plant collection from forests, fishing, and other ventures, there exists a heightened risk of cuts and wounds. Consequently, a significant number of plants are also utilized for wound healing purposes, with eight species reported to possess such properties. Furthermore, diverse plants were identified for treating liver problems, malaria, blood pressure issues, and fever. The most frequently cited plant family was Fabaceae, represented by seven species, followed by Asteraceae and Lamiaceae each represented by six species and Amaranthaceae, Apocynaceae and Amaranthaceae with five species each. Additionally, Zingiberaceae, Cucurbitaceae, Musaceae, Piperaceae, Solanaceae, and Rutaceae each contributed four or three species, while the remaining families accounted for one to two species each. In terms of administration, the most common methods included the application of paste, direct consumption, or the extraction of juices, as well as incorporating plants into meals as vegetables. These plants are collected from either the forest or most of the plants are commercially sold in the market as vegetables.

Table-1 Findings of the survey showing medicinal plants with its significant treatment

SL.NO	VERNACULAR NAME	SCIENTIFIC NAME	FAMILY	PART USED	HABIT/HABITAT	DISEASE CURED
1	Bhedailota	*Paederia foetida*	Rubiaecea	Leaf	Climber	Upset Stomach
2	Manimuni	*Centella asiatica*	Apiacaea	Leaf	herb	Upset stomach, Acne healing
3	Lajuki lota	*Mimosa pudica*	Fabacaea	Roots	Small Shrub	Piles, Headache
4	Kathanda	*Tabernaemontana divaricata*	Apocynaceae	Leaf	Tree	Small pox, Eye burn
5	Nayantara	*Catharanthus roseus*	Apocynaceae	Flower, Root	Shrub	Diabetes, Hair care
6	Nirku Tita	*Chassalia curviflora*	Rubiaceae	Bark	Shrub	Stomach ache, Worms
7	Naraxinho	*Murraya koenigil*	Rutaceae	Leaf	Tree	Upset stomach
8	Neem	*Azadirachta indica*	Meliaceae	Leaf, Stem	Tree	Body rash, Tooth Cavity, Worms
9	Kolmou	*Ipomoea aquatica*	Convolvulaceae	Leaf	Perennial herb	Low BP, Fever
10	Bonphuk	*Leucas aspera*	Lamiaceae	Leaf	Herb	Sinus, Small pox, Jaundice
11	Omita	*Carica papaya*	Caricaceae	Fruit, Leaf	Tree	Skin treatment, Constipation, Gastric
12	Dalim	*Punica granatum*	Lythraceae	Fruit, Leaf	Tree	Blood gain, Dysentery, High fever
13	Aloe vera	*Aloe vera*	Asphodelaceae	Leaf	Succulent	Skin and hair treatment
14	Joba phul	*Hibiscus rosa-sinensis*	Malvaceae	Leaf, Flower	Shrub, Small Tree	High fever, Hair treatment
15	Halodhi	*Curcuma longa*	Zingiberaceae	Fruit	Tree	Cough, Pain relief
16	Laai saak	*Brassica juncea*	Brassicaceae	Leaf	Herb	Diabetes
17	Tulosi	*Ocimum tenuiflorum*	Lamiaceae	Leaf	Herb	Cough, Rashes
18	Paate goja paat	*Bryophyllum pinnatum*	Crassulaceae	Leaf	Perennial Succulent	Upset Stomach
19	Mandhania	*Eryngium foetidum*	Apiaceae	Leaf	Herb	Stomach ease, Fever
20	Xewali phul	*Nyctanthes arbor-tristis*	Oleaceae	Leaf	Tree	Liver problem, Diabetes
21	Sirota tita	*Andrographis paniculata*	Acanthaceae	Leaf	Herb	Stomach pain

22	Goru gaa dhua paat (Nephaphu)	*Clerodendrum colebrookianum*	Lamiaceae	Leaf	Shrub	High BP, Piles
23	Neelkot teeta	*Chassalia curviflora*	Rubiaceae	Root	Shrub	Dysentery
24	Sojona	*Moringa oliefera*	Moringaceae	Flower	Tree	Small pox
25	Lao paat	*Lageneria siceraria*	Cucurbitaceae	Leaf	Climber	Vitamin
26	Kolphul	*Musa acuminata*	Musaceae	Fruit	Tree	Low BP
27	Dhekia	*Diplazium esculentum*	Athyriaceae	Leaf	Shrub	Stomach ease
28	Kola kochu	*Colocasia esculenta*	Araceae	Stem	Herb	Haemoglobin increment, Jaundice
29	Musondari	*Houttuynia cordata*	Saururaceae	Leaf	Herb	Stomach ache, Dysentery
30	Madhuriam	*Psidium guajava*	Myrtaceae	Tender Leaf	Tree	Dysentery
31	Laai Jabori	*Drymaria cordata*	Caryophyllaceae	Leaf	Perennial herb	Stomach cramps
32	Monmoti tenga	*Dalbergia tamarindifolia*	Fabaceae	Leaf	Tree	Jaundice
33	Bahika	*Phlogacanthus thyrsiformis*	Acanthaceae	Fruit, Leaf	Shrub	Stomach ease, cough
34	Helosi	*Enydra fluctuans*	Asteraceae	Leaf	Herb	Upset stomach
35	Narikol	*Cocos nucifera*	Arecaceae	Fruit, water inside the fruit	Tree	Stomach ease, jaundice
36	Posotiya	*Vitex negundo*	Lamiaceae	Leaf	Shrub	Body pain, Appetite loss
37	Bih dhekia	*Dryopteris felix-mas*	Dryopteridaceae	Leaf	Shrub	Body pain
38	Bel gos	*Aegle marmelos*	Rutaceae	Leaf, Fruit	Tree	Diabetes, Stomach ease
39	Arjun gos	*Terminalia arjuna*	Combretaceae	Bark	Tree	Jaundice
40	Xilikha	*Terminalia chebula*	Combretaceae	Fruit	Tree	Stomach ease, Constipation
41	Seket tenga	*Oxalis corniculate*	Oxalidaceae	Leaf	Herb	Urinary tract problem like concentrated urine
42	Jolokia	*Capsicum frutescens*	Solanaceae	Fruit	Herb	Pain absorbent
43	Tita kerela	*Momordica charantia*	Cucurbitaceae	Fruit	Shrub	Diabetes
44	Brahmi saak	*Bacopa monnieri*	Plantaginaceae	Leaf	Aquatic herb	Sharpening brain
45	Puronnoboi saak	*Boerhavia diffusa*	Nyctaginaceae	Leaf	Perennial herb	Jaundice, Concentrated urine
46	Xiju	*Euphorbia neriifolia*	Euphorbiaceae	Leaf	Small tree	Cough
47	Bhim kol	*Musa balbisiana Colla*	Musaceae	Bark, Peel	Tree	Cough, Khaar
48	Aada	*Zingiber officinale*	Zingiberaceae	Stem	Herb/Spice	Sinus, Cough
49	Pani lao	*Lageneria siceraria*	Cucurbitaceae	Fruit	Climber	Upset stomach
50	Bokul	*Mimusops elengi*	Sapotaceae	Bark	Tree	Tooth ache
51	Garo maah	*Cajanus cajan*	Fabaceae	Leaf	Shrub	Jaundice, Appetite loss
52	Jarmoni	*Spilanthes paniculata*	Asteraceae	Fruit, Leaf	Shrub	Mouth sores healing
53	Narzi phul	*Tagetes erecta*	Asteraceae	Leaf	Perennial Herb	Wound healing
54	Anaros	*Ananas comosus*	Bromeliaceae	Leaf	Tree	Vomiting
55	Madar	*Erythrina variegate*	Fabaceae	Leaf	Tree	Vomiting

56	Paan	*Piper betle*	Piperaceae	Bud	Climber	Period cramps
57	Paleng	*Spinach oleracea*	Amaranthaceae	Leaf	Herb	Stomach ease, Low BP
58	Khutura	*Amaranthus viridus*	Amaranthaceae	Leaf	Subshrub	Upset stomach, Low BP
59	Kehraaj	*Eclipta prostrata*	Asteraceae	Leaf	Herb	Hair oil
60	Nemu	*Citrus limon*	Rutaceae	Leaf, Fruit	Tree	Rashes, Vomiting, Gastric
61	Bengena	*Solanum melongena*	Solanaceae	Seed	Shrub	Tooth cavity
62	Amara	*Spondias spinata*	Anacardiaceae	Bark, Flower, Fruit	Tree	Joint pain, Blood dysentery, Kidney Stones
63	Makhana	*Euryale ferox*	Nymphaeaceae	Leaf	Rooted aquatic perennial	Diabetes, Increasing Calcium content, Wrinkles delay
64	Teteli	*Tamarindus indica*	Fabaceae	Leaf	Tree	Wound healing, Constipation, High BP
65	Pudina	*Mentha spicata*	Lamiaceae	Leaf	Herb	Upset stomach, Digestion
66	Suhani	*Acmella paniculata*	Asteraceae	Leaf	Shrub	Tooth ache
67	Bihlongi	*Persicaria glabra*	Polygonaceae	Leaf	Herb	Wound healing
68	Titbhaduri	*Solanum anguivi*	Solanaceae	Leaf, Root	Undershrub	Diabetes, Tonsil
69	Kasiduria	*Lindernia crustacea*	Linderniaceae	Leaf	Herb	Stomach ease
70	Mesta tenga	*Hibiscus subdarifa*	Malvaceae	Leaf	Herb	Stomach ease
71	Abhuta gos	*Achyranthes aspera*	Amaranthaceae	Root, Stem	Herb	Jaundice, Appetite loss
72	Dubori bon	*Cynodont dactylon*	Poaceae	Leaf	Creeping Herb	Jaundice, Stop bleeding from cuts
73	Tejimola	*Iresine herbstii*	Amaranthaceae	Leaf	Shrub	Wound healing
74	Saal	*Shorea robusta*	Dipterocarpaceae	Bark	Tree	Blood dysentery, Piles
75	Era gos	*Ricinus communis*	Euphorbiaceae	Leaf	Shrub	High fever, sprain, Swelling due to injury
76	Godhuli gopal	*Mirabilis jalapa*	Nyctaginaceae	Root	Shrub	White discharge in females
77	Mitha borial	*Scoparia dulcis*	Plantaginaceae	Root	Herb	White discharge in female
78	Moira tikira	*Elephantopus scaber*	Asteraceae	Root	Herb	Excessive period bleeding
79	Pipoli	*Piper longum*	Piperaceae	Bud	Shrub	Tonsil
80	Jaati jaluk	*Piper nigram*	Piperaceae	Fruit	Climber	Sinus, Cough
81	Elaichi	*Elettaria cardamomum*	Zingiberaceae	Seed	Small Tree	Tonsil, Mouth freshener
82	Long	*Syzygium aromaticum*	Myrtaceae	Bud	Tree	Tonsil, Tooth ache
83	Tengesi	*Oxalis corniculata*	Oxalidaceae	Leaf	Herb	Pain relief
84	Meethi saak	*Trigonella foenum-graecum*	Fabaceae	Leaf	Shrub	Jaundice
85	Aakon gos	*Calotropis procera*	Apocynaceae	Stem gum, Leaf	Tree	Tooth ache, Pain relief
86	Baah gos	*Bambusa vulgaris*	Poaceae	Tender stem , sharp outgrowths	Tree	Tooth ache, Wound healing

87	Tukuna(Bhatghila)	*Orozylum indicum*	Bignoniaceae	Bark	Tree	Jaundice, Wound healing, malaria
88	Xorpo gondha	*Rauvoifia serpentina*	Apocynaceae	Root	Shrub	Stomach pain
89	Thoikera tenga	*Garcinia pedunculata*	Clusiaceae	Fruit	Tree	Stomach ease
90	Dupor tenga	*Kalanchoe pinnata*	Crassulaceae	Leaf	Shrub	Stomach ease, Kidney stones
91	Karabi	*Thevetia peruviana*	Apocynaceae	Flower gum	Tree	Wound Healing
92	Xoguni lota (Giloy)	*Tinospora cordifolia*	Menispermaceae	Bark	Climber	Diabetes
93	Bhingaraj	*Wedellia calendulacea*	Asteraceae	Leaf, Bark	Perennial herb	Kidney disfunction, Dysentery
94	Mati kaduri	*Alternanthera sessilis*	Amaranthaceae	Leaf	herb	Lung troubles, Asthma
95	Nobaji	*Portulaca grandiflora*	Portulacaceae	Leaf	Succulent Herb	Wound Healing
96	Harixonkor	*Cordyline fruticosa*	Asparagaceae	Leaf	Small tree	Dysentery in cows
97	Kharua paat	*Streblus asper*	Moraceae	Leaf, Stem	Tree	Jaundice, Tooth ache
98	Bathua	*Chenopodium album*	Amaranthaceae	Leaf	Herb	Low BP
99	Nohoru	*Allium sativum*	Amaryllidaceae	Fruit	Herb	High BP
100	Amla	*Phullanthus emblica*	Phyllanthaceae	Fruit	Tree	Vitamin C, Skin treatment, Stomach ease
101	Kaskol	*Musa paradisiaca*	Musaceae	Fruit	Tree	Dysentery
102	Podum	*Nelumbo nucifera*	Nymphaeaceae	Root	Herb	Dysentery
103	Boga bhet	*Nymphaea alba*	Nymphaeaceae	Stem	Herb	Dysentery
104	Boch	*Acorus calamus*	Araceae	Rhizome	Herb	Dysentery
105	Robab tenga	*Citrus grandis*	Rutaceae	Fruit	Tree	Worm, Blood purifier
106	Kunduli	*Cocccinia grandis*	Cucurbitaceae	Root	Climber	Diabetes
107	Ou tenga	*Dillenia indica*	Dilleniaceae	Fruit	Tree	Dysentery
108	Gomari	*Gmelina arborea*	Verbenaceae	Leaf	Tree	Dysentery
109	Dighloti	*Litsea calicifolia*	Lauraceae	Leaf	Tree	Upset stomach
110	Bok phul	*Sesbania grandiflora*	Fabaceae	Leaf	Tree	Sore throat
111	Tokma	*Hyptis suaveolens*	Lamiaceae	Seeds	Small tree	Concentrated urine
112	Kol posola	*Musa paradiciaca*	Musaceae	Whole plant juice	Small tree	Uric acid

Table 2**:** Number of plants used in each significant treatments of diseases

Disease	**Number of plants**
Upset stomach	37
Digestion	18
Diabetes	8
Joint Pain	8
Wound healing	8
Tooth Cavity	6
Blood pressure	8
Mouth sores	1
Cough	7
Skin and Hair treatment	11
Worms	3
Tonsil	3
Jaundice	11
Liver	1
Piles	3
Swellings	2
Pox	3
Sinus	2
Hemoglobin deficiency	2
Urinary tract issue	3
Brain development	2
Period problem	4
Kidney stones	2
Malaria	1
Lung problem	1
Uric acid	1

Parts of the plant used in the treatments

Discussion

The leaves are the predominantly used plant part in treating a wide array of diseases. They are frequently employed either through direct consumption, preparation into paste form, or inclusion in culinary dishes as vegetables. Following leaves in therapeutic significance are the roots of the plants. These roots are typically administered through boiling or processing into a paste before use.

Furthermore, the bark of various plants played a significant role in traditional remedies. Often, the bark is soaked in water overnight, and the resulting infusion is consumed the following day, or it is combined with other medicinal substances for consumption. Additionally, stems of certain plants are harnessed for preventive dental care measures. They are either utilized directly for brushing teeth or immersed in water for utilization.

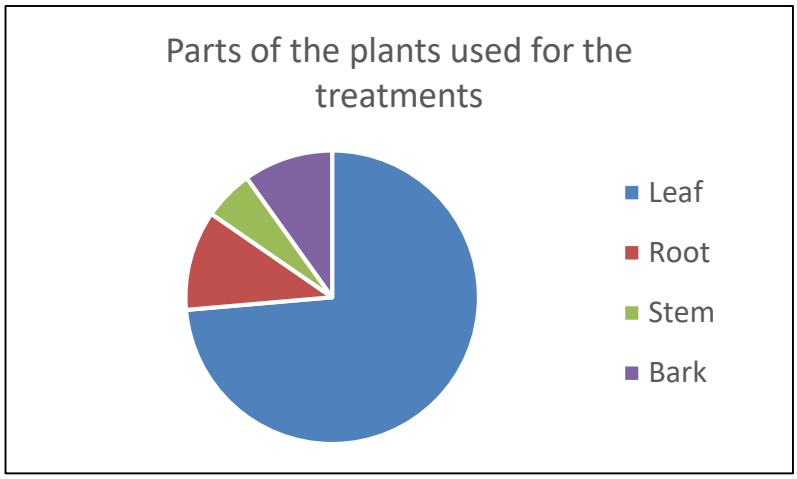

fig:3 pie chart representing parts of the plants used in the treatment

IV. CONCLUSION

Understanding the medicinal properties of plants holds considerable significance within various ethnic communities. Traditional healers serve as the primary custodians of this knowledge. However, the traditional uses of medicinal plants are gradually diminishing due to factors such as inadequate data storage, developmental projects, and other human-induced activities. Consequently, there is an urgent imperative to compile comprehensive data and implement effective conservation strategies to sustain these invaluable botanical resources.

Furthermore, it is essential to undertake phytochemical and pharmacological investigations of these medicinal plants. Such research endeavors can unlock their potential as sources of drugs and modern medicine, thereby contributing to advancements in healthcare.

V. ACKNOWLEDGMENT

I am deeply grateful to the local community living near Deepor Beel for their cooperation and trust in sharing their valuable knowledge and sparing their precious time for my work.

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