Ethnobotany and urban life: medicinal and food use of plants from Karachi (Pakistan's largest metropolis)

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Research

Abstract

Background: Traditional medicines knowledge is more famous and well-documented in rural and remote areas in Pakistan and worldwide than in urban areas. A present effort was made to document the ethnobotanical practices among the communities of Karachi city and provide the basis for the development of natural drug discovery.

Methods: For ethnobotanical data collection, 177 local informants and traditional healers were interviewed. Various quantitative indices such as the relative frequency of citation (RFC), fidelity level (FL), use value (UV), and the Jaccard Index (JI) were applied to the documented data.

Results: The traditional medicinal uses of 97 plant species belonging to 47 families were reported. Solanaceae (seven taxa) was followed by Boraginaceae and Fabaceae (six taxa each), Cucurbitaceae (five taxa); Amaranthaceae, Convolvulaceae, Malvaceae, Verbenaceae, and Zygophyllaceae (four taxa each), which were the leading families that contributed the highest number of taxa. The highest plant-used parts were leaves, with 45 reports (28.84%), followed by fruit (15.38%). It was observed that the majority of species were used to treat stomach problems, respiratory issues, general wellness, skin conditions, liver-related conditions, and fever, respectively.

Conclusion: Ethnomedicinal findings reported in this study offer concrete proof of the use of therapeutic plants by residents of Karachi city. The research also showed that the medicinal plants in the region constitute a significant source of herbal medicines used to treat various ailments. This survey can serve as a starting point for future scientific research aimed at creating new plant-based pharmaceuticals for the market.

Keywords: Ethnobotany; Karachi, Sindh, Human diseases, Herbal medicine

Background

Ethnobotanical appraisals of medicinal plant species are useful for developing herbal medicines as well as for protection and conservation (Mesfin *et al*. 2009; Vitalini *et al*., 2013). At this time, ethnomedicinal research is necessary to be able to exploit native plant species for the discovery of new herbal medicines (Ijaz *et al*. 2021). In many places around the world, plants have been extensively used, and their usage for therapeutic purposes has been documented (Nadembega *et al*. 2011). Because herbal pharmaceuticals are used to treat several human diseases, medicinal plants are essential to the majority of disease cures (Rehecho *et al*., 2011). Additionally, ethnobotanical studies point to the significance of medicinal plants in the particular cultural context of the area. These studies could improve the socioeconomic situation in a region, protect local communities' understanding of their native plants, and eventually help protect the world's cultural heritage (Sanz-Biset *et al*. 2009).

Between 400 and 600 medicinal plants are used in Pakistan's traditional healthcare system (Shinwari and Qaiser 2011). Herbal home remedies are the foundation of Pakistan's traditional healthcare system. Numerous ethnobotanical investigations have been carried out since 2008 in several regions of Pakistan (Qureshi *et al*. 2009, Ijaz *et al*. 2022). Pakistan is gifted with an array of climates, topographical regions, and ecological zones that hold a diversity of medicinal plants (Hussain *et al*. 2010), and it is reported that ethnobotanical surveys of therapeutic plants have not yet been conducted in the arid regions of Sindh province. Deforestation, famines, prolonged droughts, relocation of traditional healers, and lack of ethnobotanical recording in the past have all contributed to the serious depletion of residents' indigenous knowledge in this region (Kadir *et al*. 2013).

Instead, a review of the literature since 2008 shows that numerous ethnobotanical studies have been conducted in Pakistan's diverse regions. They suggest that around 700 plant species, mostly from the north, are employed as remedies. Native plants are well known for their culinary applications as well as their medicinal and tonic properties.

Most of the medicinal plants from Sindh province are used as a key source of herbal medicines for basic healthcare in many rural areas, Karachi is the City of this province which is regarded as a desert region of the country (Yaseen *et al*. 2015). Ethnobotany studies are well established in the neighboring provinces of Punjab and Baluchistan, according to a review of the literature. To the author's knowledge, no previous work from this region (Karachi) has been documented or published. Few types of research have been reported from Sindh Province. As a result, this quantitative ethnobotanical survey is being conducted for the first time in Karachi to record the region's traditional medicinal plant applications as well as food uses. The next goal of this study is to record medicinal flora along with trends of using native medicinal plants among urban people while they are facilitated with modern facilities. We applied ethnobotanical quantitative indices (UV, RFC, ICF, RI, FIV, and JI) to record and compare residents' knowledge and how the medicinal plant knowledge differs from existing regional ethnomedicinal studies.

Materials and Methods

Study area

Karachi (24°45′ N-25°37′ N and 66°42′ E to 67°34) is the capital of Sindh province (Figure 1) in Pakistan's south. It is the country's largest city and main seaport, as well as a significant commercial and industrial center. Karachi is situated on the Arabian Sea's shore, just northwest of the Indus River delta. Along the harbor's edge, a low-lying coastal strip runs (Karim *et al.* 2014). Away from the coast, the land rises gently to the north and east, forming a vast plain with elevations ranging from 5 to 120 feet (1.5 to 37 meters), on which Karachi is built. The Malir River, a seasonal stream, runs through the city's eastern section, while the Layri River, another seasonal stream, goes through the city's most densely populated northern section. In the north and east, there are a few ridges and isolated hills; Mango Pir at 585 feet, is the highest point (Zafar and Zaidi 2019).

The weather in Karachi is pleasant for most of the year. The hottest months are May and June when the average maximum temperature is around 93 degrees Fahrenheit (34 degrees Celsius). In May and October, enervating weather can occur, with temperatures reaching 105 degrees Fahrenheit (41 degrees Celsius). Karachi Harbour, which is located on the city's shoreline, is a secure and attractive natural harbor. Kiamri Island, Manora Island, and Oyster Rocks, which block the majority of the port entrance in the west, shelter it from storms. The city and its suburbs occupy over half of the territory, while agricultural land and wasteland cover the other 332 square miles (Hussain *et al.* 2010).

Data collection

Before beginning the surveys, the Center for Plant Conservation's ethics board was consulted, and the representative of the town also provided approval for the survey's legal conduct. After outlining the potential objective repercussions of the study in the local language, prior authorization was obtained from each respondent using the participatory appraisal (PA) method outlined in the Kyoto Protocol. No clinical trials were conducted on the informants. The informants were divided into categories including gender, age, caste, degree of education, and place of residence. Through triangulation, the accuracy of the ethnobotanical data was verified. The data was then examined numerically and qualitatively while being compared to the available literature.

Species identification

Numerous field trips were made in different seasons during 2020-2021, following the method suggested previously (Phillips and Gentry1993). Each plant species was collected from different areas of the city. The specimens were appropriately pressed, dried, and mounted on standard herbarium sheets, and voucher specimens were prepared following the method described by Yabesh *et al*. (2014). The Flora of Pakistan was used for the identification of the plants. The APG IV (2016) was followed for the exact family names, and Gonza´lez-Tejero *et al*. (2008) and the World Flora Online (https://www.worldfloraonline.org) were followed for the current position of scientific names of the species. All identified plant specimens were then deposited in the herbarium. (Prof. Dr. S.I. Ali Herbarium, Center for Plant Conservation, University of Karachi).

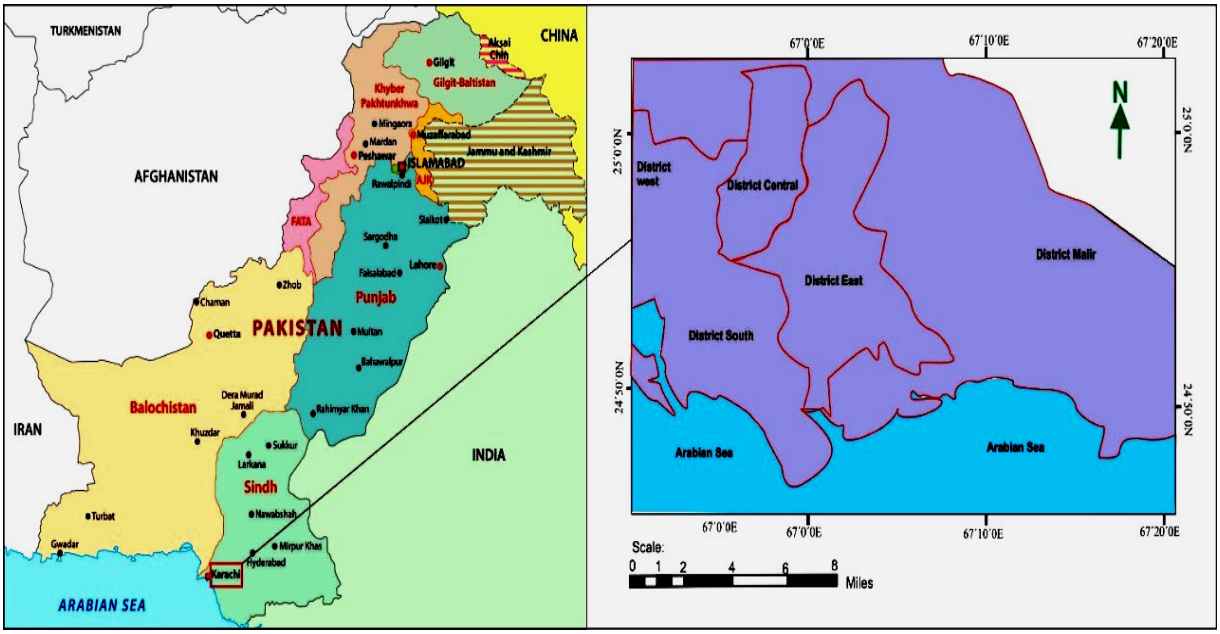

Figure 1. Map of the study area

Interviews with participants

Ethnomedicinal information was gathered from 177 local informants, using semi-structured interviews, questionnaires, group discussions, and field observations. Convenience sampling was used to randomly select the informants, and the sample size was calculated using Kadam and Bhalerao's approach (Farooq *et al*. 2019). The questionnaire was created using the approach by Edward *et al* (Voeks 2007). Additionally, the ethical rules of the International Society of Ethnobiology (http://www.ethnobiology.net/ were scrupulously adhered to taking ethical considerations into account.

Data processing

Quantitative indices

Relative frequency of citation (RFCs).

The frequency of citation (RFC), or the number of informants citing the use of a species, is used to calculate the importance of each species. Without considering the usage categories, the FC value is divided by the total number of informants who took part in the survey (N) (Tardıo and Pardo-de-Santayana 2008).

$$RFCs = FC/N$$

Where FCs is the proportion of respondents who reported using a certain plant species, and N is the total number of respondents.

Use Value (UV)

The use-value (UV), which reflects the relative significance of each plant species used by the informants in the study range, is a measure of its use. The value was determined using the following suggested formula (Ijaz *et al.* 2021).

$$\mathrm{UV} = \frac{\sum U_i}{n}$$

Where n denotes the overall number of informants questioned for a given plant, and Ui denotes the number of use reports for a given plant species that each informant has cited (Yabesh *et al.* 2014). The UV parameter makes it possible to identify which plants are most frequently employed for a given purpose. As a result, UV is high when a lot of informants name the plant and low when there aren't many uses reported.

Fidelity level (FL)

The percentage of informants that use a specific plant species for the same purpose is known as the fidelity level (FL), and it is determined as follows:

$$FL\ (\%) = Ni/N \times 100$$

Where, N = the number of informants who use the plants as a medicine to treat any given condition; Ni = the number of informants who claim the use of a plant species to treat a specific illness (Friedman *et al.* 1986).

Novelty index (Jaccard index)

By contrasting recent findings with previously published studies from aligned regions, the novelty index (Jaccard index (JI)) was derived. The formula below was employed:

$$\mathrm{JI} = \frac{\mathrm{C}}{(\mathrm{A} + \mathrm{B} - \mathrm{C})} \mathrm{X}\ 100$$

Where A is the number of species in area A (current study), B is the number of species in area (published study), and C is the number of species that are common to both A and B (González-Tejero *et al.* 2008).

Results and Discussion

Demography of participants and status of traditional knowledge

In this study, we interviewed 177 informants including 31% men and 27.68% women who belong to ten different casts; among them, 71 were temporarily settled in the city for employment, and 106 were permanently settled. If we look at the percentage distribution of the interviewed cast, Urdu speaking, Sindhi, Punjabi, Pathan, Balochi, Saraiki, Kashmiri, Hazarewal, Gilgiti, and Chitrali are considered with percentages of 16.66, 13.88, 13.88, 8.88, 8.33, 13.33, 5.55, 7.22, 7.22, and 3.88, respectively. All demographic data, such as educational status, age, and gender, are shown in (Table 1). We noticed that among all the participants, 90 were found to be healers, familiar with the use of plants against diseases. During the study, it was observed that traditional knowledge was stronger among the elders (people over fifty years of age). If we look at it from the perspective of casts, the knowledge is more prevalent among Urdu Speaking, Saraiki, Sindhi, Balochi, Punjabi, and Pathan, respectively. Very few people from the remaining casts were aware of plant usage, especially the medicinal applications of plants. This is due to the unique flora (because these people belong to different geographical zones), so there is a gap in the transfer of knowledge within the same cast. Urdu-speaking people came from India during separation, where the trend of curing diseases through customary medicine was common. That is the reason that people still use traditional medicine against diseases. Saraiki, Punjabi, and Sindhi are involved in the nursery business in the city and are associated with several wild plants. Saraiki (a cast from the southern Punjab province) is also associated with gardening jobs in the city and has a lot of knowledge of indigenous plant usage. Although most patients are treated with modern medicines, there are several Hakims who cure diseases by using several native plants. However, many plants are sold by Hakims, such as *Withania coagulans* (fruit and seeds), *Withania somnifera* (fruit and seeds), *Ziziphus numularia* (fruits), *Cassia senna* (leaves), *Coccinia grandis*(fruits), *Cocculus hirsutus* (fruits), and *Moringa oleifera* (leaves).Among the commercial plants, *Moringa oleifera* was reported as a highly sold plant by Hakim, as well as through social media marketing (Figure 2)

Table 1. Demographic data of Participants

Cast	Gender		Age groups			Education					Status		Percentage
	Male	Female	20-40	41-60	Above 60	Illiterate	Matriculation	Intermediate	Bachelor	Master	Permanently settled	Temporarily settled	
Urdu speaking	20	10	6	10	14	9	6	5	7	3	30	00	16.66
Sindhi	20	5	3	7	15	11	4	4	2	4	15	10	13.88
Punjabi	18	7	3	12	10	5	7	4	3	1	13	12	13.88
Pathan	12	4	4	7	5	7	2	2	2	3	8	8	8.88
Balochi	10	5	2	9	4	6	1	2	3	3	7	8	8.33
Saraiki	20	4	4	15	5	11	7	2	1	3	11	13	13.33
Kashmiri	7	3	3	4	2	3	2	1	2	1	4	5	5.55
Hazarewal	10	3	2	7	4	5	1	2	3	2	9	4	7.22
Gilgiti	7	5	1	6	5	2	1	1	1	7	5	7	7.22
Chitrali	4	3	2	3	2	1	1	1	1	2	3	4	3.88

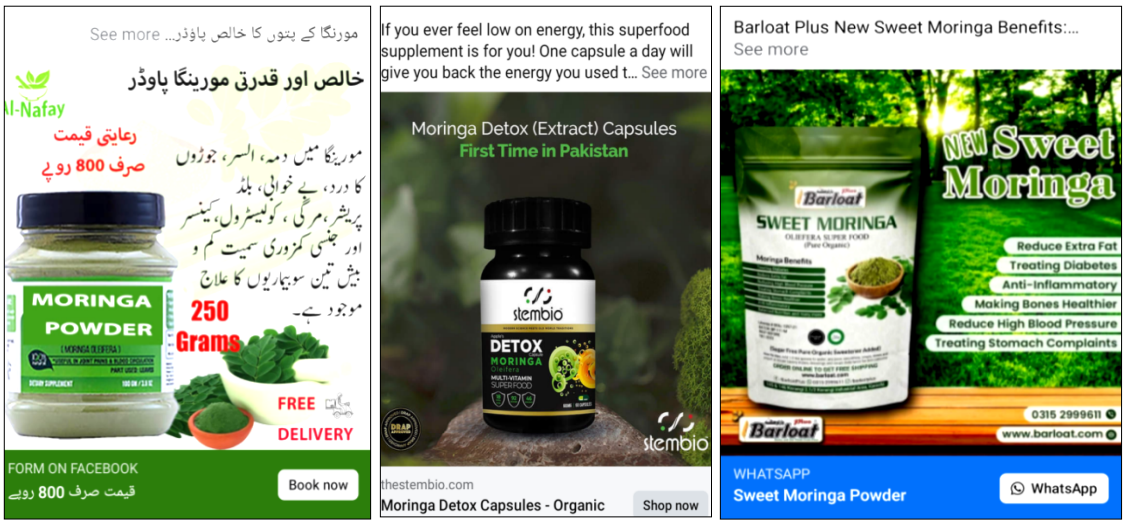

Figure 2. Some posts of *Moringa* plant on social media marketing (Facebook page).

Taxonomic diversity

We found 97 medicinal plants belonging to 78 genera and 47 families used by the local inhabitants of Karachi city (Table 2). Explanatory statistics showed that Solanaceae was the leading family, contributing seven species, followed by Boraginaceae and Fabaceae with six medicinal species each. Cucurbitaceae and Malvaceae had five taxa each, while Amaranthaceae, Convolvulaceae, and Zygophyllaceae were recorded with four taxa each. Four families - Apocynaceae, Capparaceae, Cleomaceae, and Lamiaceae - were recorded with three medicinal taxa each. Apocynaceae, Capparaceae, and Cleomaceae were recorded with three medicinal species each. Nine families, namely Acanthaceae, Aizoaceae, Asteraceae, Burseraceae, Commelinaceae, Meliaceae, Salvadoraceae, Sapotaceae, and Tamaricaceae, were reported with two species each. The remaining twenty-six families (Anacardiaceae, Aristolochiaceae, Asclepiadaceae, Asphodelaceae, Bignoniaceae, Caesalpiniaceae, Capparidaceae, Celasteraceae, Elatinaceae, Fumariaceae, Gisekiaceae, Menispermaceae, Mimosaceae, Moringaceae, Nelumbonaceae, Neuradaceae, Nitrariaceae, Oxalidaceae, Papaveraceae, Plumbaginaceae, Polygonaceae, Portulacaceae, Primulaceae, Rhamnaceae, Sapindaceae, and Verbenaceae were reported with one medicinal plant each (Table 3). Almost all reported plants were gathered from the wild, while a few of them are cultivated.

Table 2. Ethnomedicinal application and food uses plants from Karachi city, Sindh, Pakistan

Family	Species, Voucher number	Local name	Part(s) used	Habit	Ailment(s) cured/ Medicinal properties/ Gastronomic uses	FC	RFCs	FL	UV	Status of use report from previous research
Acanthaceae	*Barleria prionitis subsp. Induta* (C.B.Clarke) Brummitt & J.R.I.Wood. KHI309	Khussara	Leaves, Seeds, Root	S	Whooping cough and tuberculosis. Leaves juice is typically given to children in catarrhal conditions together with sugar or honey and chewed to soothe toothaches. To treat boils and glandular swells, use root paste.	41	0.231	22.59	0.14	1Ω, 2□, 3□, 4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Acanthaceae	*Blepharis sindica* Stocks ex T. Anderson., KHI335	Asad	Seeds	US	Boiling seeds in milk are used for backaches and joint pain/Seeds used as tonic.	22	0.124	23.16	0.17	1*, 2Ω, 3Ω, 4Ω,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18, 19, 20□
Aizoaceae	*Portulaca oleracea* L., KHI364	Qulfasubzi	AP	H	Kidney stones, urinary inflammation, liver heat, stomach stimulant, jaundice, constipation, premature ejaculation and cold / Vegetable and tonic.	80	0.451	96.04	0.76	1*, 2□, 3□,4□,5□, 6□, 7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Aizoaceae	*Zaleya pentandra* (L.) Jeffery., KHI394	Achowaho	AP	H	Cure infection “purged", and used for snake bite, acute uro-genital tract inflammation hematuria, vomiting, and bloody feces.	08	0.045	18.07	0.12	1Ω, 2Ω, 3Ω, 4□,5□, 6□,7□, 8□,9Ω, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Amaranthaceae	*Achyranthes aspera* L., KHI349	Charchitah	AP	H	Cure symptoms of skin conditions include boils and allergies and other diseases like asthma, TB, chest diseases, scorpion sting, kidney stones, and constipation.	10	0.056	19.77	0.22	1*, 2*, 3*, 4□, 5□, 6□, 7*, 8□, 9□, 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20*
Amaranthaceae	*Aerva javanica* (Burm.f.) Juss. ex Schult., KHI314	Boohi	Root, Leaves	H	Hemorrhoids and piles, snake bites, jaundice, that reduce swelling body parts, kidney stones, cancer, and urine booster.	18	0.101	20.90	0.24	1*, 2Ω, 3*, 4*, 5□, 6□, 7□, 8□, 9□, 10*, 11□, 12□, 13Ω, 14□, 15Ω, 16□, 17□, 18□, 19□, 20
Amaranthaceae	*Amaranthus viridis* L., KHI303	Cholai sag	Leaves, AP	H	Flu, scorpion bite effect, rheumatoid arthritis, skin allergy, piles, constipation, kidney stones, gallbladder stones, diarrhea, urinary tract issues, and contraceptives/ Leaves cooked as vegetable.	55	0.310	67.79	0.63	1*, 2*, 3*, 4*, 5□, 6□, 7Ω, 8□, 9Ω, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18*,19□, 20*
Amaranthaceae	*Digera muricata* (L.) Mart., KHI358	Chanchali	Leaves, Stem, Seeds	H	Urine enhancer, kidney-ureter stones, hair loss, constipation, digestive issues, and urethral ulcer / Leaves cooked as vegetable.	48	0.271	59.88	0.55	1*, 2*, 3*, 4□, 5□, 6□, 7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω

Anacardiaceae	*Rhus mysurensis* B. Heyne ex Wight & Arn. KHI322	Dansri	Bark	S	Anti-microbial, anti-oxidant, hypolipidemic, and hepatoprotective.	22	0.124	41.24	0.30	1□, 2□, 3□, 4□, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Apocynaceae	*Vincetoxicum spirale* (Forssk.) D.Z.Li (Syn, *Blyttia spiralis* (Forssk.) D.V.Field & J.R.I.Wood. KHI319	Ambevel	AP	H	Used in the treatment of gonorrhea and as a purgative.	07	0.039	18.64	0.21	1□, 2□, 3□, 4□, 5□,6□,7□, 8□, 9□,10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Apocynaceae	*Leptadenia pyrotechnica* (Forssk.) Decen. KHI351	Khip,kip	Flower, Fibers, Tubers	S	Antibacterial, expectorant and cure cough, kidney disorders, stones, urinary disease.	33	0.186	17.51	0.13	1*, 2□, 3□, 4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14Ω, 15□, 16□, 17□, 18□, 19□, 20□
Apocynaceae	*Periploca aphylla* Decne. KHI379	Bata	Latex, Stem	S	Anticancer, antiulcer, and for the treatment of inflammatory diseases, antihistaminic, stomachic and tonic.	24	0.135	11.86	0.11	1□,2□, 3□, 4□, 5□,6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Aristolochiaceae	*Aristolochia bracteolata* Lam. KHI388	Kidamar, Gandhati	AP	H	Roundworms are removed using the root decoction. Bruised leaves are administered topically to treat eczema. Children with colic may also have them placed on their navels. Emmengogue and anthelintic.	40	0.225	23.16	0.25	1□, 2*, 3*, 4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Asclepiadaceae	*Calotropis procera* (Aiton) Dryand. KHI306	Akk	Latex, Bark, Leaves	S	Plant latex is comparable to *Calotropsis gigantea's*. Plant havinganti-inflammatory properties. Leprosy and asthma are treated with the bark and leaves.	96	0.542	51.97	0.54	1Ω, 2□, 3□, 4Ω, 5□, 6Ω,7*,8□, 9Ω, 10*, 11□, 12□, 13Ω, 14Ω, 15*, 16□, 17□, 18□, 19□, 20Ω
Asphodelaceae	*Asphodelus tenuifolius* Cav. KHI342	Piazi, Pimaluk	AP, Seeds	H	It functions as a febrifuge, a remedy for haemorrhoids and colds, and a treatment for rheumatic discomfort. Additionally, seeds are administered topically to ulcers and inflamed areas to treat them and act as a diuretic.	80	0.451	40.11	0.32	1*, 2Ω, 3Ω, 4□, 5□, 6□, 7□, 8□, 9□,10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Asteraceae	*Orbivestus cinerascens* Sch.-Bip. KHI301	Lalia	Leaves	H	Leaves paste is applied topically to cure skin diseases.	36	0.203	6.21	0.18	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Astraceae	*Cyanthillium cinereum* (L.) H.Rob. KHI357	Iron weed	leaves and root	H	Anti-flammatory immunomodulatory anthelmintic and diurectic.	23	0.129	12.42	0.16	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□,13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□

Bignoniaceae	*Tecomella undulata* (Roxb.) Seeman. KHI317	Lahura	Leaves, Flower	T	Syphilis, gonorrhea, hepatitis, tumours, conjunctivitis, syphilis, hepatitis, as a blood purifier, and used in the treatment of wounds.	17	0.096	31.07	0.19	1□, 2□, 3□, 4*, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Boraginaceae	*Arnebia hispidissima* (Lehm.) A. DC. KHI397	Khari	Root	H	Useful in treatment of stomach and respiratory diseases, boils, heart ailments,and antimicrobial.	92	0.519	55.93	0.50	1□, 2□, 3Ω, 4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Boraginaceae	*Cordia sinensis* Lam. *(Syn, Cordia gharaf* (Forssk.) Ehren. KHI304	Ghundii	Fruit Leaves, Bark	T	Dyspepsia, joint discomfort, fever, diarrhea, leprosy, gonorrhea, and burning feeling are all treated with leaves and stem bark/ Fruit (ripe) is eaten.	57	0.322	70.62	0.58	1□, 2□, 3□, 4*, 5□, 6□, 7□, 8, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω
Boraginaceae	*Cordia myxa* L. KHI341	Lasura	Fruit	T	Fruit used for the treatment of wounds and ulcers, as well as to relieve coughing and chest discomfort/ Ripe fruit is eaten.	61	0.344	54.23	0.57	1□, 2□, 3Ω, 4□,5□, 6Ω,7*, 8*, 9□,10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Boraginaceae	*Heliotropium currasivacum* L. KHI362	Kharsan	Leaves, Root	H	Used in case of wound inflammation, skin allergy, skin disorders, skin boils, skin cancer and blood purification as well as bone fracture.	26	0.146	20.90	0.14	1*, 2*, 3*, 4□, 5□, 6□, 7□, 8□, 9□,10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Boraginaceae	*Heliotropium subulatum* (DC.) Vatke. KHI363	Kharsan	Leaves, Root	H	Liver heat, jaundice, blood purifier, malaria blood producer, stomach stimulant and stop bleeding from cut part.	26	0.146	20.90	0.14	1□, 2□, 3Ω, 4□,5□, 6□,7□, 8□, 9□, 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Boraginaceae	*Trichodesma indicum* (L.) R. Br. KHI307	Kalri-buti	Leaves, Root, Flower	H	The root paste for application on the swelling mainly of the joints. The flowers are reported to be employed as sudorific and cough. It has also febrifuge, carminative, depurative, emollient, and diuretic properties.	20	0.112	20.90	0.15	1□, 2Ω, 3*, 4*, 5□,6□,7□, 8□, 9Ω, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Burseraceae	*Commiphora stocksiana* (Engl.) Engl. KHI311	Bayisa-gugal	Latex	S	Gum is useful against bone fracture, skin disease, joint pain, and abortion.	104	0.587	53.67	0.52	1*, 2□,3□, 4Ω,5□, 6□, 7□, 8□, 9□, 10□, 11□, 12□, 13□, 14Ω, 15□, 16□, 17□, 18□, 19□, 20□
Burseraceae	*Commiphora wightii* (Arn.) Bhandari. KHI312	Gugal	Latex	S	It is also used to adulterate myrrh. Possesses properties like antiarthritic. Antichosteraemic, antilipidaemic, antiobesity, anti-inflammatory, and anti-acne.	104	0.587	53.67	0.52	1*, 2□,3□, 4□, 5□, 6□, 7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15Ω, 16□, 17□, 18□, 19□, 20□

Caesalpiniaceae	*Senna holosericea* (Fresen.) Greuter *Syn, Cassia holosericea* Fresen. KHI321	Janglisenna	Leaves	H	Used as a laxative, for stomach diseases as well as useful for body pain.	54	0.305	37.85	0.28	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Capparaceae	*Crataeva adansonii* DC. KHI381	Barna	Bark	T	Bark is used to treat asthma, constipation, postmenopausal complaints, snakebites, and cancers/ Bark used as a tonic.	30	0.169	16.38	0.22	1□, 2□, 3□,4□,5□, 6□, 7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20
Capparaceae	*Cleome gynandra L. Syn, Gynandropsis gynandra* (L.) Briq.KHI 354	Purhar, Hulhul, Akiya	Leaves, Seeds	H	The root is used to treat fevers and as a vesicant and rubefacient seeds are useful in the treatment of rheumatism anthelmintic and rubefacient/Tonic.	26	0.146	17.51	0.12	1□, 2Ω, 3Ω, 4□, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Capparaceae	*Maerua arenaria* Hook. f. & Thomson. KHI371	Marua	Root	H	This plant's fleshy roots are used as a natural stimulant and tonic. Additionally, the herb is used to treat scorpion and snake bites.	18	0.101	12.99	0.45	1□, 2□, 3□, 4□, 5□, 6□,7□,8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Capparidaceae	*Capparis decidua* (Forssk) Edgew. KHI327	Karil, Kalair	Leaves, Fruit, Root, Bark	ST	Young leaves are used as a poultice on boils and hives. They chewed to ease their toothaches. It is prescribed for rheumatism and remitting fevers. The roots are aphrodisiac, anodyne, expectorant, digestive, carminative, and antibacterial, it is useful for asthma, cough, hiccoughs, swellings, boil eruptions, and filthy ulcers/ Fruit used in pickled.	84	0.474	50.28	0.55	1*, 2□, 3□, 4*, 5□, 6*,7□, 8*Ω, 9□, 10*, 11□, 12□, 13□, 14*Ω, 15□, 16□, 17□, 18□, 19□, 20Ω
Celasteraceae	*Gymnosporia senegalensis* Loes. *Syn, Maytenus senegalensis* (Lam.) Exell. KHI391	Hekel	Bark, Root	ST	Respiratory diseases, inflammation, and topical application for healing wounds. Root and bark is used to treat dysentery.	15	0.084	27.11	0.19	1□, 2□, 3□,4□,5□, 6□, 7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Cleomaceae	*Cleome brachycarpa* Vahl ex DC.KHI372	Shamako	Leaves	H	Effective for treating soreness, itchiness, burning, infectious infections, white spots of skin, ligament disorders, bone diseases (arthritis, rheumatism), muscle swelling, and skin rashes.	26	0.146	19.20	0.20	1□, 2*, 3*, 4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16, 17, 18□, 19□, 20□

Cleomaceae	*Cleome gynandra* L. KHI373	Ponwar	Leaves, Seeds	H	The seeds and leaves are used both internally and externally to cure rheumatism and as rubefacients and vesicants. The leaves are used to treat Diarrhoea, while an infusion of the roots is utilized as a medication for chest pain.	29	0.163	19.20	0.20	1□, 2□, 3□, 4□, 5□,6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Cleomaceae	*Cleome viscose* L. KHI374	Shamako	Leaves	H	Effective for rheumatic, fever and dyspepsia, malaria, arthritis, hypertension, neurasthenia, and wound healing.	31	0.175	18.64	0.20	1□, 2□, 3Ω, 4□, 5□, 6□,7□, 8□,9□, 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Commelinaceae	*Commelina africana* L. *Syn, Commelina benghalensis* L. KHI386	Kanchara	Leaves	H	Used for skin inflammations and laxative.	21	0.118	23.72	0.16	1□, 2□, 3□, 4□, 5□,6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Commelinaceae	*Commelina paludosa* Blume. KHI333	Kanjuna	Root	H	Root is used to treat fever, vertigo, and snake poison.	23	0.129	14.68	0.16	1□, 2□, 3□, 4□, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Convolvulaceae	*Convolvulus glomeratus* Choisy. KHI329	Ghass bail	AP	H	Plant is used as purgative	20	0.112	9.60	0.15	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Convolvulaceae	*Cressa cretica* L. KHI330	Rudranti		H	Useful to cure leprosy, diabetes, ulcers, asthma, and urinary discharges.	17	0.096	11.29	0.12	1□, 2Ω, 3Ω,4□, 5Ω, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Convolvulaceae	*Ipomoea aquatic* Forsk. KHI395	Ganthian, Nari	AP	H	It serves as an anthelmintic, laxative and is used to treat piles, nosebleeds.	40	0.225	21.46	0.23	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□,14□, 15□, 16□, 17□, 18□, 19□, 20□
Convolvulaceae	*Ipomoea pes-caprae* (L.) R.Br. KHI332	Samudraphen	AP	H	The mucilaginous herb is considered to have astringent, tonic, alterative, and diuretic properties. Leaves are applied externally in rheumatism and colic.	66	0.372	31.63	0.15	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad. KHI302	Indryan	Fruit	H	The pulp is said to have hydragogue, cathartic, and severe purgative effects, treating fevers, instances, chronic constipation and dropsy, and bilious derangements. It is regarded as a vermifuge and emmenagogue. It serves as a	106	0.598	62.14	0.53	1*, 2Ω, 3Ω, 4*, 5*, 6*, 7Ω, 8□, 9□, 10*, 11□, 12□, 13Ω, 14Ω, 15*, 16□, 17□, 18□, 19□, 20*

					mouthwash and irritating countermeasure for chest colds.				
Cucurbitaceae	*Coccinia grandis* (L.) Voigt. KHI392	Kanduri	Fruit	H	Leprosy, jaundice, asthma, bronchitis, skin eruptions, burns, tongue sores, earaches, indigestion, eye infections, nausea, insect bites, and fever are all conditions that can be treated with plants.	100	0.564	59.88	0.53	1□, 2□, 3□, 4Ω, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Cucurbitaceae	*Cocculus hirsutus* (L.) Diels. KHI313	Jamti-ki-bel, Farid Buti	Fruit	US	Rheumatic pains are treated using leaves and root. Mucilage is present in the leaf juice when combined with later light, a jelly is created that is used as a cooling treatment for gonorrhea / Used as tonic.	110	0.620	29.37	0.53	1□, 2□, 3□, 4Ω, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Cucurbitaceae	*Momordica balsamina* L.KHI365	Jangli karela	Fruit	C	Plants considered stomachic and anti-HIV, anti-plasmodial, anti-Diarrhoeal, anti-septic, anti-bacterial, anti-viral, anti-inflammatory, anti-microbial, hypoglycemic, analgesic and hepatoprotective properties/ Cooked as vegetable.	122	0.689	27.68	0.38	1Ω, 2□, 3□, 4□,5□, 6□,7Ω, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Cucurbitaceae	*Cucumis maderaspatanus* L. *(Syn, Mukia madaraspatana* (L.) M.Roem. KHI383	Chirati	Leaves, Root and Fruits	C	This plant has a wide range of therapeutic benefits, including those for dental discomfort, dyspepsia, vertigo, coughing, constipation, and coughing up blood. The fruits, roots and leaves are diuretic, antipyretic, anti-ulcer, and stomachic.	14	0.079	12.99	0.10	1Ω, 2□, 3Ω, 4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Elatinaceae	*Bergia suffruticosa* (Delile) Fenzl. KHI377	Rohwan	Leaves	US	Leaves used as poultice on sores and broken bone and in the cure osteitis and wounds healings.	28	0.158	5.08	0.10	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Fabaceae	*Senna occidentalis* (L.)Link *(Syn, Cassia occidentalis* L. KHI338	Kasondi	Leaves	US	Leaves used in constipation, joint pain, stops dysentery and sexual tonic.	35	0.179	15.25	0.23	1*, 2□, 3□, 4□, 5□, 6□,7□, 8,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Fabaceae	*Senna alexandrina* Mill. *(Syn, Cassia senna* L) KHI368	Senni-Makki	Leaves	H	Dried leaves are used in rheumatism, skin diseases and against worms.	35	0.179	15.25	0.23	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□

Fabaceae	*Senna italic* Mill. *Syn, Cassia italica* (Mill.) F.W.Andrews. KHI315	Sonamukhi	Leaves	H	Backache, body pains, sciatic, and headache. Leaves are purgative and used as a substitute or adulteration for senna.	38	0.214	15.81	0.21	1□, 2□, 3*, 4□, 5□, 6□,7□,8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Fabaceae	*Pithecellobium dulce* (Roxb.) Benth. KHI324	Jungle Jalebi	Fruit, Bark	T	The bark and pulp being astringent and hemostatic are used to treat toothache and bleeding/ Fruit (ripe) is eaten.	76	0.429	46.89	0.56	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Fabaceae	*Prosopis cineraria* (L.) druce. KHI323	Jand, Kandi	Pods, Seeds, Bark, Flower	T	The bark is used as a remedy in rheumatism and scorpion bite. The leaves are good for eye troubles. The flowers pounded and mixed with sugar are eaten by pregnant women as care against miscarriage/ Seeds are eaten raw.	55	0.310	33.89	0.52	1□, 2□, 3□, 4*, 5□, 6Ω,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Fabaceae	*Parkinsonia aculeata* L. KHI352	Parkinsonia	Leaves, Seeds	T	Used as antipyretic, antimalarial, diaphoretic and abortifacient.	18	0.101	12.42	0.15	1Ω, 2□, 3□, 4□,5□, 6□,7□,8Ω, 9□, 10□, 11□, 12Ω, 13□, 14□, 15*, 16□, 17□, 18□, 19□, 20
Fumariaceae Papaveraceae	*Fumaria indica* (Husskn.) pugsley. KHI359	Pitpapra	AP	H	Used as blood purifier, dyspepsia, pains, diarrhea, fever, influenza, liver complaints, blood purification, vomiting, constipation, leukoderma, anthelmintic, diuretic, diaphoretic and, in combination with black pepper for jaundice.	24	0.135	17.51	0.23	1□, 2Ω, 3Ω, 4□,5□, 6□,7Ω, 8□,9□, 10□, 11Ω, 12□, 13*, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω
Gisekiaceae	*Gisekia pharnaceoides* L. KHI370	Buti	AP	H	Used as purgative, typically after miscarriage/Aboveground is eaten as a general strength restorative.	16	0.090	10.16	0.20	1□, 2□, 3Ω, 4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Lamiaceae	*Clerodendrum indicum* (L.) Kuntz. KHI387	Turks Turban	Root	S	Chest problems can be treated with the root, and herpetic eruptions can be treated with a cream made from the juice of the leaves and butter fat. Using a resin from the plant, syphilitic rheumatism can be controlled.	32	0.180	21.46	0.14	1□, 2□, 3□, 4□, 5□,6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Lamiaceae	*Clerodendrum phlomidis* L. KHI343	Arni	Root	S	Root is administered as a demulcent in the treatment of syphilis, gonorrhea, stomach problems, and measles recovery.	24	0.135	21.46	0.10	1□, 2□, 3□, 4*, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Lamiaceae	*Volkameria inermis* L. *Syn, Clerodendrum inerme* (L.) Gaeta.	Guldaam	Root	S	The leaves are aromatic, bitter, and mucilaginous. Both dry and fresh leaves have alterative and febrifugal effects.	37	0.209	21.46	0.14	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□

	KHI325				Buboes can be treated using a poultice made from the leaves. Boiling the root in oil yields a liniment that can be used to treat rheumatism.				
Malvaceae	*Corchorus depressus* (L.) stocks. KHI326	BohPhali, Munderi	Leaves	H	Used as emollient and cooling agent, and to treat male sexual dysfunction and impotency.	44	0.248	28.24	0.21	1*, 2Ω, 3Ω, 4□,5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Malvaceae	*Corchorus olitorius* L. KHI305	Nar Mundair	Leaves	H	Leaves are used in chronic cystitis, gonorrhea, dysuria and demulcent, de-obstruent, diuretic, galactagogue, purgative and dysentery, enteritis, fever, pectoral pains, piles, and tumor / Tonic.	31	0.175	16.94	0.21	1□, 2Ω, 3□,4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Malvaceae	*Corchorus capsularis* L. KHI316	Harrana	Leaves, Root, Seeds, Fruit	H	An infusion of leaves is used as an appetite stimulant, demulcent, stomachic, carminative, and laxative. It is also prescribed for dysentery, fever, dyspepsia, and liver diseases. Diarrhea is treated with a root and unripe fruit decoction. In heart disorders, seeds extract is employed.	39	0.220	15.25	0.14	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14Ω, 15□, 16□, 17□, 18□, 19□, 20□
Malvaceae	*Corchorus tridens* L. *Corchorus trilocularis* L. KHI384	Kaunti, kedu	Leaves, Seeds	H	When macerated with water, the mucilage is utilized as a demulcent. To lessen swellings, the leaves are applied as a plaster. The seeds are used to relieve nausea and indigestion.	28	0.158	16.94	0.21	1□, 2Ω, 3□,4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20
Malvaceae	*Grewia tenax* (Forsk.) Fiori. KHI340	Kango, Gwangi	leaves, Root, Fruits	S	Used to treat inflammatory problems, liver abnormalities, jaundice, and gastrointestinal diseases.	29	0.163	5.64	0.16	1□, 2□, 3□, 4□, 5□,6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Meliaceae	*Azadirachta indica* Adr. Juss. KHI366	Neem	Leaves, Fruit	T	Seed oil can be used as a purgative and an anthelmintic. It has anti-inflammatory properties that help treat inflammatory conditions like acne, nourish skin, treat fungus infections, detoxify the body, and boost immunity, useful for gastrointestinal illnesses and diabetes/ Fruit is edible.	145	0.819	81.35	0.79	1*, 2□,3□, 4□,5*, 6*7*, 8*, 9*, 10*, 11Ω, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω
Meliaceae	*Melia azedarach* L. KHI345	Bakain	Leaves, Seeds,	T	The leaves and seeds are regarded as emmenagogue, diuretic, anthelmintic, and antilithic, stomachic and astringent	101	0.570	53.67	0.54	1□, 2□, 3□,4□, 5□, 6□,7Ω, 8Ω, 9Ω, 10*, 11□, 12□, 13*, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω

			Gum, Flower		properties when decocted. When skin conditions flare up, a poultice made from the flowers is used to kill lice. The tree's gum is thought to be helpful in spleen enlargement. The plant has calming and stimulating properties.				
Menispermaceae	*Cocculs pendulus* (J.R & G. Forst) Diels. KHI336	Pilwan	Fruit	S	Leaves and root used in rheumatic pains, Hypotensive and anti-cancer.	13	0.073	9.60	0.24	1□, 2□, 3□, 4□, 5*, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Mimosaceae	*Senegalia Senegal* (L.) *(Syn, Britton Acacia Senegal* (L.) willd. KHI350	Khair	Gum	T	Gum is used as demulcent and as an emulsifying agent and sexual disease also for making mucilage.	36	0.203	27.11	0.29	1*, 2□, 3□, 4Ω,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14Ω, 15□, 16□, 17□, 18□, 19□, 20□
Moringaceae	*Moringa oliefera* Lam. KHI382	Sohajna, moringa	Leaves, Bark, Flower	T	It is used in the treatment of ascites, rheumatism, and as cardio and circulatory stimulants, skin tumors, jaundice, tiredness, high blood pressure, eye problems, diabetes, swellings and used as tonic.	150	0.847	59.88	0.73	1*, 2□, 3□, 4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15*, 16□, 17□, 18□, 19□, 20□
Nelumbonaceae	*Nelumbo nucifera* Gaertn. KHI360	Nilufer	Seed Rhizome Flower	H	Seeds are used to treat cutaneous disorders. Worm infestation and sporadic fevers can all be treated with flowers. When treating ringworm and other skin conditions, the rhizomes are used as paste used to treat skin discoloration, menorrhagia, diarrhea, dysentery, and intrauterine development retardation / The rhizome is also eaten as a vegetable.	45	0.254	22.03	0.23	1□, 2□, 3□, 4□, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Neuradaceae	*Neurada procumbens* L. KHI389	ChapariKuadhal	Leaves and Seeds	H	Expedient to cure cardiovascular diseases, strong stimulant, cooling agent and for debility and impotency / Tonic.	11	0.062	14.12	0.20	1□, 2Ω,3*, 4□, 5□, 6□,7□, 8□, 9□,10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Nitrariaceae	*Peganum harmala* L. KHI310	Harmal, Ispand	Seed	H	Effects on cardiovascular, neurological, antimicrobial, insecticidal, anti-neoplasmic, antiproliferative, gastrointestinal, and antidiabetic systems; seed powder used in asthma, colic, and jaundice; and as an anthelmintic against tapeworms.	43	0.242	32.76	0.31	1□, 2□, 3□,4*, 5□, 6□,7Ω, 8□, 9□, 10□, 11□, 12□, 13*, 14□, 15*, 16□, 17□, 18□, 19, □ 20□

Oxalidaceae.	*Oxalis corniculata* L. KHI320	Khatti Booti	Leaves	H	Anesthetic, anti-inflammatory, digestive, carminative, liver-tonic, diuretic, constipating, febrifuge, antibacterial, vermifuge, and digestive aids. It helps with dyspepsia, fever, diarrhea, dysentery, scurvy, corns, and warts. Swollen ulcers. Strangulation, hemorrhages, dysmenorrhea, amenorrhea, cephalalgia, and ophthalmopathy / Leaves are eaten raw.	89	0.502	79.66	0.68	1¤, 2¤, 3¤,4¤,5¤,6¤, 7Ω, 8¤, 9Ω,10Ω, 11¤, 12*, 13*, 14¤, 15¤, 16¤, 17¤, 18¤, 19¤, 20Ω
Papaveraceae	*Argemone mexicana* L. KHI376	Pilawal datura	Seeds, AP Root	H	Plant (juice) is used in dropsy, cough, wounds, ulcers and skin diseases and jaundice. It also functions as a diuretic. The seeds are highly narcotic and emetic. They are employed for diarrhea and dysentery; the roots are helpful for itching, inflammation, leprosy, skin problems, and guinea worm infestation.	25	0.141	24.29	0.28	1¤, 2¤, 3¤,4¤, 5¤, 6¤,7¤, 8¤, 9¤, 10¤, 11¤, 12¤, 13¤, 14¤, 15¤, 16¤, 17¤, 18¤, 19¤, 20¤
Plumbaginaceae	*Limonium stocksii* (Boiss.) O. Kuntze. KHI347	Limium	Leaves	S	Possess as cardioprotective, antimicrobial, hepatoprotective, anti-inflammatory and anticancer activity.	30	0.169	15.81	0.22	1¤, 2¤, 3¤,4¤, 5¤, 6¤,7¤, 8¤, 9¤, 10¤, 11¤, 12¤, 13¤, 14¤, 15¤, 16¤, 17¤, 18¤, 19¤, 20¤
Polygonaceae	*Calligonum polygonoides* L. KHI385	Phok	AP	S	Useful in the treatment of heat-stroke by mixing with curd. It is also reported as antidote for opium poisoning / Flowers are eaten raw.	27	0.152	8.47	0.17	1¤, 2¤, 3¤, 4¤,5¤, 6¤,7¤, 8¤, 9¤, 10¤, 11¤, 12¤, 13¤, 14¤, 15¤, 16¤, 17¤, 18¤, 19¤, 20¤
Portulacaceae	*Portulac aquadrifida* L. KHI344	Nuny ka sag, lunkibuti	Leaves, Flower, Seeds	H	Leaves applied as an external treatment for erysipelas and a diuretic in cases of dysuria. Seeds as vermifuge drug/ Cooked as vegetable.	41	0.231	22.59	0.14	1¤, 2¤, 3¤, 4¤,5¤, 6¤,7Ω, 8¤, 9¤, 10¤, 11¤, 12¤, 13*, 14¤, 15¤, 16¤, 17¤, 18¤, 19¤, 20Ω
Primulaceae	*Anapallis arvensis* L. KHI348	Billi booti	AP	H	Molluscicidal, anti-inflammatory, anti-leishmanial, antiviral, cytotoxic, anti-mycotic, anti-microbial, anti-leishmanial, and spermatogenesis.	08	0.045	7.34	0.15	1¤, 2¤, 3¤, 4¤, 5¤, 6¤,7¤, 8¤,9Ω,10Ω, 11¤, 12¤, 13¤, 14¤, 15¤, 16¤, 17¤, 18¤, 19¤, 20¤
Rhamnaceae	*Ziziphus numularia* (Burm.f.) W. & Arn. KHI334	Malla, jherberi	Fruit	S	Scabies and boils, colds, diarrhea, dysentery, indigestion, gum irritation, and tonic are treated with leaves/ Fruit is eaten raw.	94	0.531	41.24	0.48	1*, 2¤, 3¤, 4Ω, 5¤,6¤,7Ω, 8¤, 9¤,10*, 11¤, 12¤, 13¤, 14Ω, 15*, 16¤, 17¤, 18¤, 19¤, 20Ω*

Salvadoraceae	*Salvadora oleoides* Decne. KHI355	Pilu, jhal, Khabbar	Fruit, Root, Leaves	S	Leaves are used against cough. Root (bark) is used as a vesicant. Fruits are employed in the treatment of enlarged spleen, rheumatism and low fever / Fruit (ripe) is eaten.	122	0.689	60.45	0.72	1*, 2□, 3□, 4*, 5□, 6□,7Ω, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15Ω, 16□, 17□, 18□, 19□, 20□
Salvadoraceae	*Salvadora persica* L. KHI356	Pilu	Fruit, Root, Leaves	S	Leaves are used against cough. Root (bark) is used as a vesicant. Fruits are employed in the treatment of enlarged spleen, rheumatism and low fever/ Fruit (ripe) is eaten.	122	0.689	60.45	0.72	1*, 2□, 3□, 4*, 5□, 6*, 7□, 8□, 9□, 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Sapindaceae	*Dodonaea viscosa* (L.) Jacq. KHI375	Sanatha	Stem, Leaves	S	Stem or leaves infusions are used to treat sore throats, rheumatism and fever; root infusions to treat colds. The seeds are used (in combination with honey) to treat malaria.	37	0.209	18.64	0.16	1□, 2□, 3□, 4□, 5□,6□, 7□, 8□, 9□, 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Sapotaceae	*Madhuca longifolia* (Koenig) Macbride. KHI378	Mahua	Fruit, Leaves, Bark	T	Respiratory infections, intestinal worms, and episodes of weakness and malnutrition. Diabetes, rheumatism, and dental issues are treated with the bark extract.	35	0.197	17.51	0.14	1□, 2□, 3□,4□, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Sapotaceae	*Manilkara kauki* Dubard *(Syn, Mimusops elengi* L. KHI393	Mol-sari	Fruit, Leaves	T	Fever, acne, and diarrhea are all treated with it; the leaves also relieve headaches.	23	0.129	16.38	0.12	1□, 2□, 3□, 4□,5□, 6□,7□, 8□, 9□, 10□, 11Ω, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Solanaceae	*Datura innoxia* Miller. KHI396	Datura	Seeds	H	The intoxicating and deadly seeds are also used to treat hydrophobia.	79	0.446	61.58	0.50	1*, 2□, 3□, 4□,5□, 6□,7Ω, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω
Solanaceae	*Physalis divericata* D.Don. KHI390	Ground Cherry	Fruit	H	It functions as a diuretic, purgative, analgesic, anthelmintic, and abortifacient in addition to having antifertility, antiulcer, antibacterial, and anti-gonorrheal properties.	75	0.423	43.50	0.33	1*, 2□, 3□, 4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Solanaceae	*Solanum villosum* Mill.(*Syn, Solanum incanum* L) KHI328	Waangnii-Dhatooro	Root, Leaves	S	Plants parts (root and leaves) are medicinally important used in case of toothache, sore throats and in chest complaints.	41	0.231	22.03	0.16	1Ω, 2□, 3□, 4□,5□, 6□,7□, 8□, 9□, 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□

Solanaceae	*Solanum virginianum* L. (*Syn, Solanum surattense* Burm. f.) KHI380	Kanderi	Fruit	H	Cured problems of the nails, cough, asthma, fever, sore throat, and blood purification.	33	0.186	20.33	0.15	1*, 2*, 3*, 4□, 5□, 6Ω, 7□, 8□, 9Ω 10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20*
Solanaceae	*Solanum americanum* Mill. KHI367	Mako	Fruit	H	Effective against jaundice and for treating asthma. Fruit is laxative and appetite stimulant/ Tonic.	39	0.220	45.76	0.41	1□, 2Ω,3*, 4*, 5□, 6□,7□, 8□, 9□,10*, 11□, 12□, 13Ω, 14□, 15□, 16□, 17□, 18Ω, 19□, 20*
Solanaceae	*Withania coagulans* (Stocks) Dunal. KHI353	Panirband	Fruit	S	The fruit is consider as sexual tonic and also has emetic and diuretic and coagulating properties/ Fruit (ripe) is eaten.	111	0.627	60.45	0.49	1*,2□,3□, 4Ω,5□, 6□, 7□,8□, 9□, 10□, 11*, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20Ω
Solanaceae	*Withania somnifera* (L.) Dunal. KHI339	Askan	Fruit	S	The root is used in rheumatism and debility and fruit are used in case of sexual weakness in male. Plant has sedative properties.	109	0.615	60.45	0.49	1□, 2□, 3□, 4Ω,5□, 6□,7Ω, 8□, 9□, 10□, 11*, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20*Ω
Tamaricaceae	*Tamarix aphylla* (L.) H.Karst. KHI308	Athel pine	AP, Bark	T	The bitter, astringent, and aphrodisiac bark is used as a demulcent in cases of venereal illness. It is also used to cure dermatitis and capititis.	25	0.141	0.09	0.10	1□, 2□, 3□, 4*, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14Ω, 15Ω, 16□, 17□, 18□, 19□, 20□
Tamaricaceae	*Tamarix dioica*Roxb. ex Roth. KHI318	Ghaz	Leaves, Fruit	ST	Used as an astringent therapy for live inflammation as well as a diuretic and carminative.	27	0.152	0.09	0.10	1□, 2□, 3□, 4□,5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14Ω, 15□, 16□, 17□, 18□, 19□, 20□
Verbenaceae	*Phyla nodiflora* (L.) Green. KHI325	Makna, Wakna, Jalpapli	AP	H	It is used for knee joint pain, for constipation, for ulcers and boils, and for enlarged cervical glands.	19	0.107	4.51	0.10	1□, 2Ω, 3Ω, 4Ω, 5□, 6□,7Ω, 8□, 9□,10*, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□
Zygophyllaceae	*Zygophyllum indicum* (Burm.f.) *Christenh.* & *Byng (Syn, Fagonia indica* Burm.f. KHI346	Dhamao,	Leaves	H	Effects include those that are anti-diabetic, anti-cancer, anti-leishmanial, antipyretic, anti-inflammatory, laxative, gastroprotective, and hepatoprotective.	65	0.367	61.58	0.62	1*, 2Ω, 3Ω, 4□, 5□, 6□, 7□, 8□, 9□, 10*, 11□, 12□, 13□, 14Ω, 15□, 16□, 17□, 18□, 19□, 20□
Zygophyllaceae	*Tribulus terrestris* L. KHI337	Gokshur	AP	H	Chest pain, an enlarged prostate, sexual difficulties, infertility, and numerous other diseases.	33	0.186	28.24	0.37	1*, 2Ω, 3*, 4*, 5□, 6□, 7□, 8□, 9*, 10*, 11□, 12□, 13*, 14Ω, 15□, 16□, 17□, 18□, 19□, 20Ω
Zygophyllaceae	*Zygophyllum propinquum* Decen. KHI331	Alveena	AP, Seeds	H	Used for the cure of dry scaly patches, skin cleaning, and as an anti- inflammatory and analgesic and seeds are anthelmintic	25	0.141	22.03	0.31	1□, 2□, 3□, 4□, 5□, 6□,7□, 8□,9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□

Zygophyllaceae	*Zygophyllum simplex* L. KHI361	Alethi	AP, Seeds	H	Aerial part is used for skin cleaning, Seed is applied to eyes in opthalmia and leucoma	47	0.265	22.03	0.15	1□, 2□, 3□, 4*, 5□, 6□,7□, 8□, 9□, 10□, 11□, 12□, 13□, 14□, 15□, 16□, 17□, 18□, 19□, 20□

Ω = Dissimilaruse(s) reported, □ = Plant not reported,*= same use(s) reported, S= Shrub, US= Under shrub, H= Herb, T=Tree, ST= Shrub to Small Tree, C= Climber, US= Under Shrub, C=Climber, AP= Aerial part, 1=Yaseen *et al*. (2015), 2= Qureshi and Bhatti. (2008), 3= Qureshi *et al*. (2010), 4=Panhwar and Abro. (2007), 5= Memon*et al* (2010), 6= Hussain *et al*. (2012), 7= Munir *et al*. (2022), 8= Waheed*et al*. (2020), 9=Siddique*et al*. (2021), 10= Nisar*et al*, (2014), 11= Bibi *et al*. (2022), 12=Ali and Qaiser. (2009), 13= Bibi *et al*. (2014), 14= Qureshi. (2012), 15= Hussain *et al*. (2013), 16= Noor *et al*. (2014), 17= Fahad and Bano. (2012), 18=Ijaz *et al*. (2021), 19=Ijaz *et al*. (2022), 20=Ishtiaq *et al*. (2021)

Table 3. Reported families along with the reported number of genera and species

Family	Genera	Species	Family	Genera	Species	Family	Genera	Species
Acanthaceae	2	2	Cleomaceae	1	3	Nitrariaceae	1	1
Aizoaceae	2	2	Commelinaceae	1	2	Oxalidaceae.	1	1
Amaranthaceae	4	4	Convolvulaceae	3	4	Papaveraceae	1	1
Anacardiaceae	1	1	Cucurbitaceae	5	5	Plumbaginaceae	1	1
Apocynaceae	3	3	Elatinaceae	1	1	Polygonaceae	1	1
Aristolochiaceae	1	1	Fabaceae	4	6	Portulacaceae	1	1
Asclepiadaceae	1	1	Fumariaceae	1	1	Primulaceae	1	1
Asphodelaceae	1	1	Gisekiaceae	1	1	Rhamnaceae	1	1
Asteraceae	2	2	Lamiaceae	2	3	Salvadoraceae	1	2
Bignoniaceae	1	1	Malvaceae	2	5	Sapindaceae	1	1
Boraginaceae	4	6	Meliaceae	2	2	Sapotaceae	2	2
Burseraceae	1	2	Menispermaceae	1	1	Solanaceae	4	7
Caesalpiniaceae	1	1	Mimosaceae	1	1	Tamaricaceae	1	2
Capparaceae	3	3	Moringaceae	1	1	Verbenaceae	1	1
Capparidaceae	1	1	Nelumbonaceae	1	1	Zygophyllaceae	3	4
Celasteraceae	1	1	Neuradaceae	1	1			

Part(s) used, food application and aliment(s) cured

All reported plants have medicinal applications used against various diseases (Table 4, Figure 5). Among all documented plants, herbs were seen as the chief contributors (53%) in terms of ethnomedicinal use. Shrubs accounted for 21%, trees for 14%, under shrubs for 4%, shrubs to small trees for 3%, and climbers for 2%, making them the least used (Figure 3). Based on descriptive statistics, leaves of 42 species were the most commonly used medicinal part, followed by fruits (24 species), aerial parts (19 species), seeds (17 species), bark and flowers (eight species each), latex (four taxa), and stems (three species) Fiber, tubers, and pods (one species each) were less commonly used parts (Figure 4). We found 24 (24.7%) medicinal plants that are used in foodstuff; some of them are cooked as vegetables, eaten raw, or used as tonics. For example, ripe fruit of *Withania coagulans, Salvadora persica, S. oleoides, Ziziphus numularia, Azadirachta indica, Pithecellobium dulce, Cordia myxa, and Cordia gharaf* are eaten raw. Similarly, the fruit of *Capparis decidua* is used in pickles, and seeds of *Blepharissindica* and *Prosopis cineraria* are eaten. *Portulaca oleracea, Amaranthus viridis, Gynandropsis gynandra, Corchorus olitorius, Digera muricata* (young aerial parts), *Momordica balsamina* (fruit), and *Nelumbo nucifera* (rhizome) are cooked as vegetables. *Calligonum polygonoides* (flower) and *Oxalis corniculata* (leaves) are eaten raw. *Crataeva adansonii* (bark) and *Neurada procumbens* (leaves) are used as tonics.

A total of 185 health ailments recorded in the study area were assembled into 30 major categories (Table. 4). The overall number of taxa used was examined for these categories. It was shown that most species were utilized to cure digestive issues. (61 species), respiratory disorders (41 species), general health (37 species), dermatological problems (35 species), liver-associated disorders (25 species), and fever (24 species). Twenty-one species were used for urogenital disorders; nineteen taxa were used as anti-inflammatory, agents; fourteen species were used for gynecological disorders and CNS, brain, and memory-related disorders each. Sexually transmitted/microbial diseases and blood-related ailments were cured by thirteen species each. Eleven species were used for body pain, nine species were recorded for edema/swelling; joint /bone disorders, antidote for animal bites, and anthelmintic were cured by seven species each;-dental or oral ailments and body stones were cured by six species each; ophthalmological disorders, piles/fissures, and tumors were cured by five species each. Four species were cited for the cure of male sexual problems and used as appetizers; three taxa were used in the case of external parasites. Three taxa were useful against malnutrition, gland, and cardiac ailments each. One species was used for nose ailments and ear ailments each.

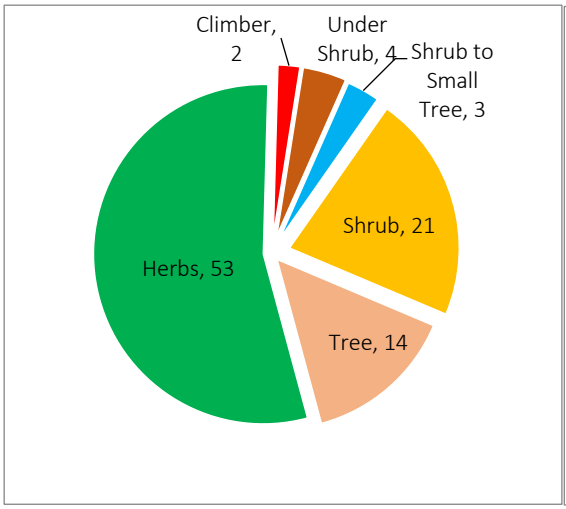

Figure 3. Life form of the plants

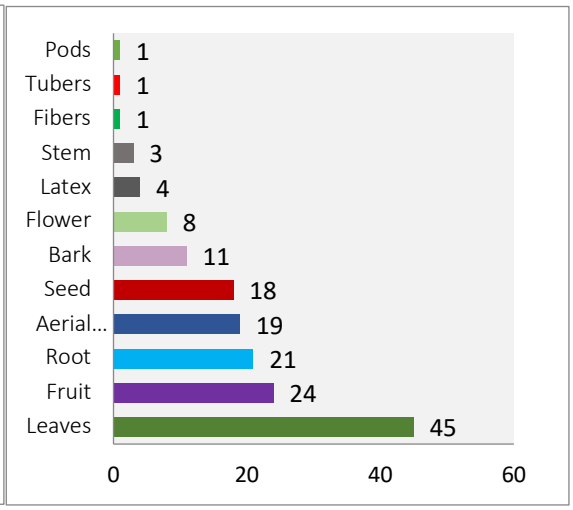

Figure 4. Plants parts used

Table 4. Disease categories based on medicinal property/ailments cured by Karachi's indigenous people with medicinal plants

Disease category	Ailments treated/Medicinal properties
Ear ailments	Ear inflammation
Nose ailments	Nose bleeding
Cardiac ailments	Heart ailments, cardio and circulatory stimulants
Gland disorders	Spleen enlargement enlarged cervical glands.
Mal nutritive disorders	Scurvy, episodes of weakness.
Ophthalmological disorders	Conjunctivitis, eye irritation/ itching, ophthalmia, leucoma, ophthalmopathy.
External parasites	Hair lice, hair loss, leishmaniasis.
Male sexual problems	Premature ejaculation, sexual weakness in males, spermatogenesis, male sexual dysfunction and impotency
Piles and fissures	Piles, hemorrhoids.
Tumor and Ulcers	Antiproliferative, antineoplasmic, swollen ulcers, antiulcer.
Body stones	Gall bladder stones, kidney stone, ureter stone.
Dental or oral ailments	Gum irritation, tongue sores, toothache.
Anthelmintic	Roundworm, tapeworm, intestinal worms, guinea worm infestation
Antidote for animal bite	Snake bite, scorpion sting, antidote for opium poisoning, insect bites.
Joint /bone disorders	Bone fracture, joint pain, osteitis.
Edema / swelling	Dropsy, swelling body parts, ascites.
Body pain	Analgesic, backache, body ache, pectoral pains, headache, earaches.
Blood related ailments	Malaria, blood pressure, blood purifier, coagulant, hemorrhage, hypertension, anticholesteremic
Sexually transmitted/ microbial diseases	Gonorrhea, measles, syphilis, HIV, bacterial and fungal infections, leprosy.
CNS, Brain and memory connected disorders	Rheumatic, arthritis, sciatica, neurasthenia, giddiness, sedative, vertigo, neurological disorders, cephalalgia.
Gynecological disorders	Emmenagogue, menorrhea, antifertility, amenorrhea. Dysmenorrhea, menorrhagia, lactagogue, abortifacient, postmenopausal complaints, abortion, contraceptives.
Anti-inflammatory	Anti-inflammatory, urinary inflammation, acute urino-genitary tract inflammation, hematuria, burning feeling, chronic cystitis, demulcent, buboes.
Urogenital disorders	Cystitis, diuretic, dysuria, haematuria,urethral ulcer, urine booster, urinary discharges, intrauterine development retardation.
Fever	Antipyretic, febrifuge, fever, malaria, sporadic fevers.
Liver associated disorders	Diabetes, liver inflammation, liver-tonic, bilious derangements, liver complaints, liver heat, hepatoprotective, jaundice, hepatitis, hypoglycemic.
Dermatological problems	Hives, eczema, burns, itching, ringworm, skin allergies, vitiligo, vesicating, wounds, boils, skin cancer, nourish skin, skin tumors, skin discoloration, skin eruptions, problems of the

	nails, scabies, dry scaly patches, dermatitis, capitis, erysipelas, corns, warts, leucoderma, rubefacients, antihistaminic.
General health	Diaphoretic, anti-cholesteremic, detoxify the body, boost immunity, immunomodulatory, tiredness, debility and impotency, tonic, strangulation, sexual tonic, stop bleeding from cut part, hypolipidemic, de-obstruent, heat-stroke, hydrophobia, herpetic eruptions.
Respiratory disorders	Cold, cough, demulcent, sore throat, flu, asthma, bronchitis, tuberculosis, chest diseases.
Gastrointestinal disorders	Diarrhea, dysentery, dyspepsia, gall bladder problem, stomach stimulant, constipation, vomiting, bloody feces, digestive issues, colic, dyspepsia, indigestion, demulcent.

Statistical data analysis

Utilizing quantitative metrics, such as Relative Frequency of Citation (RFC), homogeneity in traditional knowledge was assessed (Umair *et al*. 2017). RFC details the importance and standing of a specific medicinal plant within the target human population. Higher RFC scores imply that locals are retaining and smoothly transmitting traditional knowledge (Tounekti *et al*., 2019).

In this study, the highest RFC values were calculated for *Moringa oleifera* (150), *Azadirachta indica* (145), *Salvadora oleoides* and *Salvadora persica* (122), *Withania coagulans* (111), *Cocculus hirsutus* (110), *Withania somnifera* (109), *Citrullus colocynthis* (106), *Commiphora stocksiana* and *Commiphora wightii* (104), *Cocculus pendulus* (101), and *Coccinia grandis* (100). This indicates the constancy of customary remedial information about highly cited species. Sixty-seven species were reported below the fifty-value range. *Blyttia spiralis, Anapallis arvensis, Zaleya pentandra, Achyranthes aspera, Neurada procumbens, Cocculus pendulus, Mukia madaraspatana, Maytenus senegalensis, Gisekia pharnaceoides, Cressa cretica, Tecomella undulata,Aerva javanica, Maerua arenaria, Parkinsonia aculeata, Phyla nodiflora, Convolvulus glomeratus, and Trichodesma indicum* were reported with the lowest RF value ranges (7-20), representing their least medicinal weight.

Use Value was employed to evaluate the relative significance of the reported plants' uses. Use Value (UV) is a measurement tool frequently used to assess the relative significance of useful plants (Zenderland *et al*. 2019). The Use Value (UV) ranged from 0.10 (*Mukia madaraspatana, Bergia suffruticosa, Tamarix aphylla, Tamarix dioica, Clerodendrum phlomidi, and Phyla nodiflora*) to 0.76 (*Portulaca oleracea*). *Azadirachta indica* (0.79), *Portulaca oleracea* (0.76), *Moringa oleifera* (0.73), *Salvadora oleoides* and *Salvadora persica* (0.72), *Amaranthus viridis* (0.63), *Fagonia indica* (0.62), *Cordia gharaf* (0.58), *Cordia myxa* (0.57), *Pithecellobium dulce* (0.56), *Digera muricata* and *Capparis deciduas* (0.55), *Calotropis procera* and *Melia azedarach* (0.54),-*Citrullus colocynthis, Coccinia grandis, and Cocculus hirsutus* (0.53), *Commiphora stocksiana*, *C. stocksiana*, and *Prosopis cineraria* (0.52), *Arnebia hispidissima* and *Datura innoxia* (0.50) were reported with high UV values.

The FL, which measures the percentage of participants who declare using a specific plant species for the same main objective or requirements, was also calculated for the most frequently reported diseases or conditions. The analysis showed that 22 (5.1%) taxa had FL values above 50, while 75 (94.9%) taxa had FL values below 50. The FL values ranged from 36.4 to 95.2.

The taxa securing the highest values were *Portulaca oleracea, Azadirachta indica, Oxalis corniculata, Cordia gharaf-, Amaranthus viridis, Citrullus colocynthis, Datura innoxia-, and Fagonia indica, Digera muricata, Calotropis procera, Commiphora stocksiana, C. wightii, Capparis deciduas, Coccinia grandis, Cocculus hirsutus, Moringa oleifera, Withania coagulans, and W. somnifera.*–Several ethnomedicinal studies recommended that most useful plants have the highest FL value.

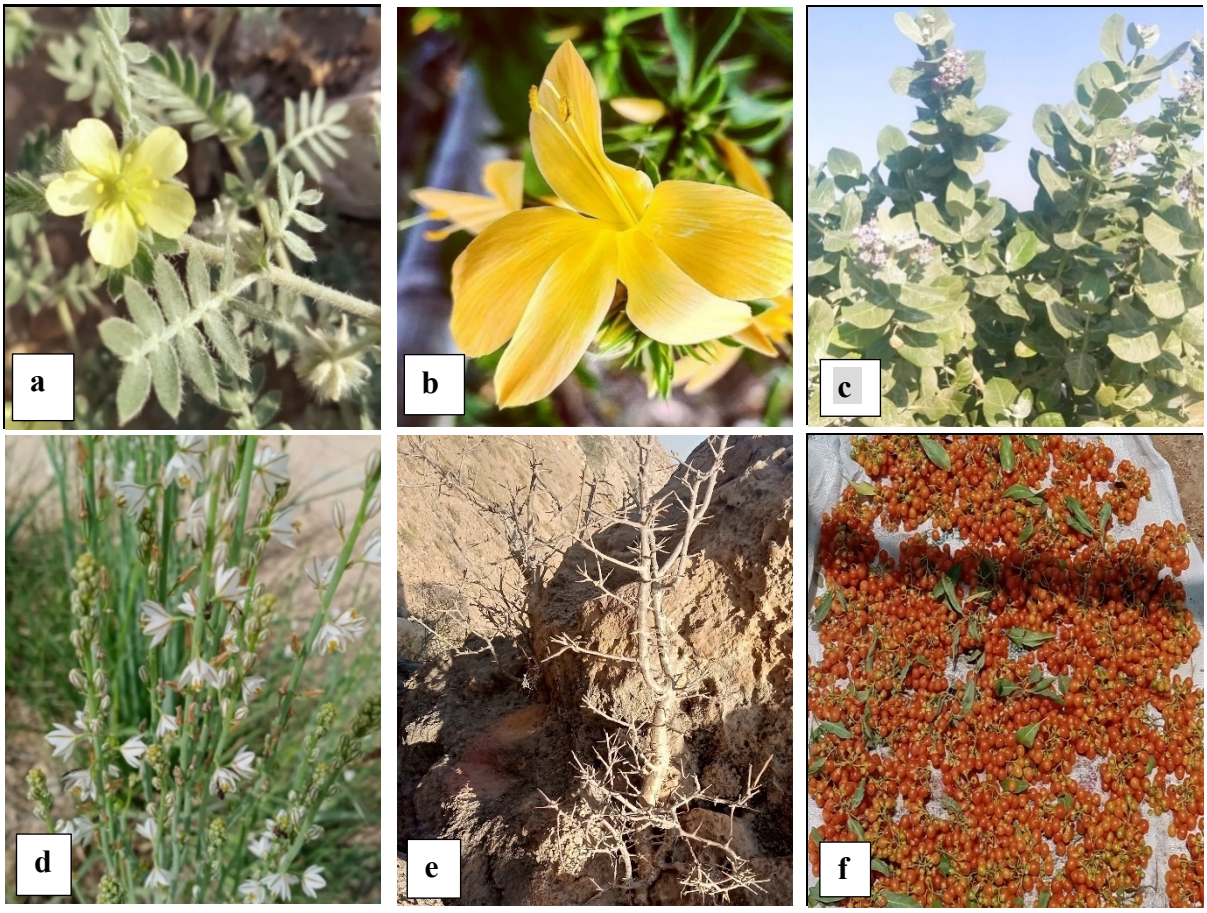

Figure 5.Photographs of some plants: (a) *Tribulus terrestris,* (b) *Barleriaprionitis*, (c) *Calotropis procera*, (d) *Asphodelus tenuifolius*, (e) *Commiphora wightii*and (f) Fruits of *Cordia sinensis.*

Novelty index

To identify new additions to the investigation, the results of the current study were compared with ethnobotanical literature. The Jaccard Index was used to calculate the similarity index (JI). This study documented that 97 medicinal plants were cross-verified in 20 published articles from the same province and neighboring provinces that had similar climatic and geographic conditions. Five studies from distinct geographic localities (GB and AJK) were also cross-verified with the current study to find common plants from diverse areas. In this study, the JI values ranged from 44.30 to 0.00 (Table 5). The maximum similarity was reported in the Thar Desert, Sindh province (Yaseen *et al*. 2015), followed by the Khirthar National Park, Sindh province conducted by Panhwar and Abro in 2007 (Panhwar and Abro 2007), the Northern Nara Desert, Sindh province (Qureshi *et al*. 2010), and the Nara Desert, Sindh province (Qureshi and Bhatti 2008). A higher JI value reflects the similarity in vegetation types of two areas due to similar geographic or climatic conditions. The lowest JI (2.15) was calculated in comparison to the studies of Bibi *et al*. (2022), Ali and Qaiser (2009), Memon *et al*. (2010), and Ijaz *et al*. (2021).The JI value was calculated as zero in comparison to the study of Noor *et al*. (2014), conducted in Astore valley, Fahad and Bano (2012) conducted in Gilgit Baltistan, and Ijaz *et al*. (2022) conducted in Neelum district, Azad Kashmir, due to the change in geography and climatic conditions. The maximum similarity (in the context of the other state) of the JI index was recorded in the study of the Bhimber district of Azad Kashmir (Ishtiaq *et al*. 2021), because the geography of this district is similar to the geography of Punjab province.

Furthermore, 27 medicinal taxa that have notbeen reported for their medicinal usage in previous research on ethnomedicine were included in the current study, namely *Rhus mysurensis, Blyttia spiralis, Periploca aphylla, Orbivestus cinerascens, Cyanthillium cinereum, Cassia holosericea, Crataeva adansonii, Maerua arenaria, Maytenus senegalensis, Cleome gynandra, Commelina benghalensis, Commelina paludosa, Convolvulus glomeratus, Ipomoea aquatic, Ipomoea pes-caprae, Bergenia suffruticosa, Cassia senna, Pithecellobium dulce, Grewia tenax*, *Nelumbo nucifera*, *Argemone Mexicana, Limonium stocksii, Calligonum polygonoides, Madhuca longifolia, Clerodendrum indicum, C. inerme, and Zygophyllum propinquum*.

Table 5. Jaccard index (Novelty index) of the medicinal flora

Citation	Study area	Province/ State	NI	TRPs	NSSU	NSDU	NPCBS	SROAA	SROSA	%SSU	%SDU	JI
Yaseen *et al*. (2015)	Thar Desert	Sindh	530	87	27	07	35	52	62	26.19	73.81	44.30
Qureshi and Bhatti. (2008)	Nara Desert	Sindh	100	51	07	17	24	27	73	6.79	93.21	31.57
Qureshi *et al*. (2010)	Northern Nara Desert	Sindh	100	63	11	16	27	36	70	10.67	89.33	34.14
Panhwar and Abro. (2007)	Khirthar National Park	Sindh	N/A	50	16	10	26	24	71	15.52	84.48	37.68
Memon*et al*. (2010)	District Umerkot	Sindh	N/A	30	03	01	04	26	93	2.91	97.09	3.47
Hussain *et al*. (2012)	District Mirpurkhas	Sindh	N/A	53	04	04	08	45	89	3.88	96.12	6.34
Munir *et al*. (2022)	District Okara	Punjab	64	126	04	13	17	109	70	3.88	96.12	10.49
Waheed*et al*. (2020)	District Kasur	Punjab	92	78	04	03	07	71	90	3.88	96.12	4.54
Siddique *et al*. (2021)	District Haripur	Punjab	80	80	02	08	10	70	87	1.94	98.06	6.80
Nisar *et al*. (2014)	District Bahawalpur	Punjab	250	123	10	02	22	101	75	9.7	90.30	14.28
Bibi *et al*. (2022)	Lesser W. Himalayas	KPK	85	66	02	03	05	61	92	1.94	98.06	3.37
Ali and Qaiser. (2009)	Chitral Valley	KPK	N/A	83	01	01	02	81	95	0.97	99.03	1.13
Bibi *et al*. (2014)	District Mastung	Balochistan	220	102	06	04	10	92	87	5.82	94.18	5.91
Qureshi. (2012)	Hingol National Park	Balochistan	N/A	39	04	09	13	26	84	3.88	96.12	10.30
Hussain *et al*. (2013)	Ormara, Gawadar	Balochistan	120	31	06	04	10	21	87	5.82	94.18	10.20
Noor *et al*. (2014)	Astore valley	GB	N/A	26	00	00	00	26	97	00	100	00
Fahad and Bano. (2012)	Gilgit Baltistan	GB	N/A	105	00	00	00	105	97	00	100	00
Ijaz *et al*. (2021)	District Neelum	AJ&K	100	66	01	01	02	64	95	0.97	99.03	1.02
Ijaz *et al*. (2022)	District Neelum	AJ&K	70	61	00	00	00	61	97	00	100	00
Ishtiaq*et al*. (2021)	District Bhimber	AJ&K	200	150	07	13	20	130	77	6.79	93.21	10.69

GB-Gilgit Baltistan; KPK-Khuber Pakhtoonkha; AJ&K-Azad Jammu & Kashmir; NI= number of Informants, TRPs= Total no. of reported plants, NSSU number of species with similar uses, NSDU number of species with different uses, NPCBS= No. of plants common in both studies, SROAA=Species recorded only in aligned area, SROSA= Species recorded only in study area, %SSU= Percentage of species with similar uses, %SDU=Percentage of species with different uses JI Jaccard index

Conclusion

Recent ethnobotanical research revealed that the citizens of Karachi city still possess a wealth of indigenous knowledge. Regardless of gender, location, and ethnicity, people from all ethnic groups preserve and share their knowledge of plants. However, the ancient people seem to be the main guardians of this wisdom. They use a wide variety of medicinal taxa as a primary source of treatment for their illnesses. The comparative analysis (JI) provides fresh valuable information while supporting the ethnobotanical findings. Notably, this study advocates for future research on plants with high quantitative ethnobotanical index values to identify bioactive chemicals that may serve as the basis for developing plant-based medicines. Future investigations into the safety and effectiveness of herbal medications are required, as well as conservation activities aimed at preserving the region's ecology and cultural heritage. The current study is devoted to policy recommendations and conservation strategies based on the study's findings, which would enhance the article's practical implications. This could serve as a guide for policymakers, urban planners, and conservationists interested in leveraging ethnobotanical knowledge for sustainable urban development.

Declarations

Ethics approval and consent to participate: All participants provided verbal prior informed consent.
Competing interests: Authors declare no conflict of interest.
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