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PHYTODIVERSITY AND CONSERVATION ASSESSMENT OF ETHNOBOTANICALLY SIGNIFICANT FLORA IN KHALL HAGRAM DARA, LOWER DIR, KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT

The current research provides first-hand information about the flora and vegetation of Siyar Dara, consisting of 332 species and 97 families. Among these, 6 species are gymnosperms, while the remaining 326 species belong to 249 genera of angiosperms. Out of these 326 species, 47 species belong to 42 genera of monocotyledonous plants, and the remaining 279 species belong to 207 genera of dicotyledonous plants. Among all 97 families, Asteraceae was the largest family, with 23 genera (9.05%) and 30 species (9.03%). Following Asteraceae, Poaceae and Lamiaceae had 24 genera (9.44%) and 16 genera (6.29%) respectively, with 25 species (7.53%) and 22 species (6.62%) respectively. Rosaceae had 10 genera (3.93%) and 14 species (4.21%), Solanaceae had 7 genera (2.75%) and 10 species (3.01%), Scrophulariaceae had 6 genera (2.36%), Ranunculaceae had 5 genera (1.96%), and Polygonaceae had 5 genera (1.96%), each with 9 species (2.71%). Boraginaceae had 7 genera, Cucurbitaceae had 5 genera, and Euphorbiaceae had 4 genera (1.57%), each with 8 species (2.409%). Brassicaceae had 6 genera (2.36%), while Amaranthaceae and Apiaceae each had 5 genera (1.96%), and Moraceae had 2 genera (0.78%), all with 6 species (1.80%). Convolvulaceae, Salicaceae, and Valerianaceae each had 2 genera (0.78%) and 3 species (0.90%). Rubiaceae had 3 genera and 3 species. Acanthaceae, Alismataceae, Crassulaceae, Nytiginaceae, Primulaceae, Urticaceae, and Verbenaceae were represented by single genera and species. A total of 90 plants were found to be used for various purposes locally, including medicinal (27.7%), fodder (25.5%), miscellaneous (16.6%), fuelwood (11.1%), timber (8.8%), vegetables (8.8%), and ornamental (1%).

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INTRODUCTION

District Lower Dir, situated in the Khyber Pakhtunkhwa province of Pakistan, is one of the most important historical and cultural regions. It is one of the 26

districts of Khyber Pakhtunkhwa (Ullah et al., 2023a). The district came into existence in 1996 when district Dir was divided into two separate districts i.e., district Lower Dir and district Upper Dir. Dir was ruled by different rulers till 1880 (Ullah and Shakir, 2023). The winter in the district is chilly and intolerable and summer is moderate and warm. The precipitation in the winter occurs due to western disturbances and the rainfall in the winter is more as compared to the summer (Sajid et al., 2023).

The hilltops are covered with sparse forests, with pine, oak, eucalyptus, acacia, ailanthus, and olea being the dominant trees in these forests (Khan et al., 2018a). The research area (Khall Hagram Dara) is situated to the north of Timergara. The southernmost point of the area lies at 34°51'40" north latitude and 71°54'50" east longitude. The northernmost point of the area lies at 34°47'22" north latitude and 71°56'03" east longitude (Ahmad et al., 2021). The altitude of the area at its lowest point is 2746 feet, and at its highest point is 7493 feet. The length of the area is approximately 9 km, and its width is about 8 km. The climate is continental, characterized by cold winters and hot summers, with variations depending on altitude (Ahmad et al., 2015). June and July are the hottest months, while January and February are the coldest. In winter, temperatures sometimes drop below freezing point (Ullah et al., 2023b). The mean maximum and minimum temperatures are 15.22°C and 32.52°C, respectively (Khan et al., 2010). Precipitation is mostly received during the winter season in the form of raindrops and snowfall in December and January. The highest recorded rainfall in March was 242.22 mm (Ullah et al., 2019). Relative humidity ranges from 30% to 70%, with higher levels in December, January, February, and August (Murad et al., 2013). Violent wind storms, known as Badama, occur during the spring season in the afternoon from Lawari Top, which can be quite chilly and intolerable. Rainfall occurs throughout the year, with more western disruptions than in the summer season. Average humidity is consistently high throughout the year (Adnan et al., 2017).

The study area lies in subtropical dry temperate areas of Pakistan with rich biodiversity. Common species include *Olea ferruginea*, *Monotheca buxifolia*, Acacia modesta, Punica granatum, *Dalbergia sissoo*, *Ficus palmata*, and *Quercus baloot* (Ullah et al., 2023c). Based on the ecological aspects of the forest communities and quantitative analysis of forest vegetation in the area, the upper areas are densely dominated by chir, fir, spruce, deodar, kail, pholai, babul, bekanrh, loor, zeitoun, akhroot, and enjeer (Fatima et al., 2018). Weed vegetation is mostly dominated by *Convolvulus arvensis*, *Avena sativa*, *Fumaria indica*, *Tulipa stellata*, and *Stellaria media*, respectively (Khan et al., 2022). Plant resource utilization, or ethnobotany, is the study of the interaction between plants and people, with special attention to old tribal cultures (Ullah et al., 2023a).

Human relations with plants fluctuate due to their uses, comparative importance, and varying social, cultural, and indigenous aspects. Similarly, ethnobotanical information helps ecologists, pharmacologists, taxonomists, and wildlife directors clarify the wealth of the area (Ibrar et al., 2007). Phytodiversity refers to the number and type of plant species in a specific geographic area (Shameem and Kangroo, 2011). Pakistan is rich in biodiversity, with a total of 6000 reported plant species (Islam et al., 2021). These plant species have been used for food, medicine, animal fodder, construction, fibers, firewood, ritual, and ornamental purposes since ancient times (Khan et al., 2018b). Additionally, these plants have a strong influence on ecosystems and play an important role in the socioeconomic development of the country (Ullah et al., 2019). In such conditions, the study of phytodiversity or biodiversity is important for the stability and proper functioning of the ecosystem (Shuaib et al., 2014). The loss of biodiversity significantly affects the stability and functioning of the ecosystem, leading to habitat loss, deforestation, pollution, extinction of indigenous species, and the introduction of new species (Bahuguna et al., 2011). Hence, conservation of biodiversity is essential for the sustainable utilization of plant resources. The major objectives of the current study are to prepare a complete floristic list of the flora of Khall Hagram Dara, to appraise plant resource utilization in the area, and to assess the conservation status of ethnobotanically important flora in the area.

MATERIALS AND METHODS

Floristic composition

Plants from Hall Dara Valley were collected from 2018-2022. They were dried, identified with the help of Flora of Pakistan, and confirmed at the National Agriculture Research Council Herbarium, Islamabad, and Herbarium Department of Botany, University of Peshawar. A

complete floristic list was compiled. Plants were arranged alphabetically within each family (Rashid et al., 2011).

Study Area

The study was conducted in the Siyar Dara region, located in District Dir Lower. Siyar Dara is characterized by diverse topography, ranging from lower valleys to higher mountainous terrain (Ullah et al., 2021).

Sampling Design

A systematic sampling approach was employed to assess the altitudinal range of plant species. The study area was divided into distinct altitude zones, with sampling sites selected at regular intervals along altitudinal gradients. Sampling sites were established at varying elevations to capture the full range of habitat conditions present in the region (Khan et al., 2018b).

Field Surveys

Field surveys were conducted during 2018-2022 to coincide with the peak growing season of the region. Trained botanists and field assistants systematically surveyed each sampling site, recording the presence and abundance of plant species within predefined quadrats or transects (Ullah et al., 2021).

Data Collection

At each sampling site, relevant environmental parameters such as elevation, aspect, slope, and soil characteristics were recorded. Plant specimens were collected and identified using standard botanical keys and taxonomic references. Specimens were carefully pressed, dried, and labeled for further analysis (Hussain and Malik, 2012).

Altitudinal Gradients

Altitudinal gradients were delineated based on elevation data obtained from topographic maps or global positioning system (GPS) measurements. The altitudinal range of plant species was assessed by recording their occurrence at multiple elevational bands throughout the study area (Hussain and Malik, 2012).

Ethical considerations

All fieldwork was conducted in compliance with ethical guidelines for scientific research. Necessary permits and permissions were obtained from relevant authorities, and efforts were made to minimize disturbance to natural habitats during data collection (Hussain et al., 2015).

Quality control

To ensure data accuracy and reliability, rigorous quality control measures were implemented throughout the study. Botanical specimens were cross-verified by multiple taxonomic experts, and data entry procedures were carefully monitored to prevent errors (Bahuguna et al., 2011).

RESULTS AND DISCUSSION

Phytodiversity

A total of 332 species belonging to 97 families of phanerogams were collected. Out of 332 species, 6 species belonging to 5 genera were of gymnosperms. The remaining 326 species belonging to 249 genera were angiosperms. Out of 326 species of Anthophyta, 47 species belonging to 42 genera were monocotyledonous and the remaining 279 species belonging to 207 genera were dicotyledonous, as shown in Tables 1 and 2.

Out of all 95 families of Anthophyta, Asteraceae was the largest family in terms of genera and species number, having 23 genera (9.055118%) and 30 species (9.035145%) followed by Poaceae and Lamiaceae having 24 (9.448819%) and 16 genera (6.299213%) respectively and 25 species (7.53012%) and 22 species (6.626506%) respectively. Next families in terms of species diversity were Papilonaceae with 12 genera (4.724409%) and 20 species (6.024096%), Rosaceae with 10 genera (3.937008%) and 14 species (4.216867%), Solanaceae with 7 genera (2.755906%) and 10 species (3.01248%) and Boraginaceae with 7 genera (2.75906%) and 8 species (2.409639%). Scrophulariaceae with 6 genera (2.362205%), Ranunculaceae with 5 genera (1.968504%), Polygonaceae with 5 genera (1.968504%) had 9 species (2.710843%) in each as shown in Tables 3, 4, 5, 6, and 7.

Boraginaceae with 7 genera, Cucurbitaceae with 5 genera, Euphorbiaceae with 4 genera (1.574803 %) had 8 species (2.409639) in each. Brassicaceae, with 6 genera (2.362205%), Amaranthaceae and Apiaceae each with 5 genera, (1.968504%) Moraceae with 2 genera (0.787402%) had 6 species (1.807229%) in each. Asclepiadaceae, Liliaceae with 4 genera (1.574803 %), Caryophyllaceae with 3 genera (1.181102%), Geraniaceae, Iridaceae, Rhamaceae with 2 genera (0.787402%) had 4 species (1.204819%) each. Convolvulaceae, Salicaceae, and Valerianaceae had 2 genera (0.787402%) and 3 species (0.903614%) each while Rubiaceae had 3 genera and 3 species as shown in Tables 8, 9, 10, 11, and 12.

Table 1: Phytodiversity of Gymnosperms (Cupressaceae and Pinaceae families).

Sr. No.	Botanical Name	Altitudinal Range	Flowering Session	Phytogeography		
				Study Area	Pakistan	World
1	*Cupressus sempervirens* L.	1000 m	Cones mature in 2 years	Tangai	Gilgit, Islamabad	West Asia, Mediterranean
2	*Thuja orientalis* L.	800 m		Barkaly	Islamabad, Peshawar	Egypt, Iran, Japan, Korea
3	*Abies pindrow* Royle	10000-12000 ft	April	Pano	Himalaya	Afghanistan, Nepal
4	*Cedrus deodara* (Roxb. Ex Lamb.)	2000-3000 m	October	Anarbagh	Kurram, Kashmir	Afghanistan ,W. Nepal
5	*Pinus roxburghii* Sargent	600-1800 m	March-April	Khawr	Himalaya, Chitral	Afghanistan, Bhutan, Sikkim

Table 2: Phytodiversity of Angiosperms (Monocots) Alismataceae, Alliaceae, Amaryllidaceae, Areaceae, and Asphodelaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering Session	Phytogeography		
				Study Area	Pakistan	World
1	*Alisma plantago- aquatica* Linn.	2800-6000 ft	June-August	Zaim	Kashmir, Hazara, Hamalaya, Sindh valley	India, Burma, Russia, Europe
2	*Sagittaria trifolia* L.	5500 ft	April-September	Laittai	Hazara, Abbottabad, Swat	Iran, Iraq, Philippines, China, Japan
3	*Allium cepa* L.	1000 m	Summer month	Safaray	Cosmopolitan	Cosmopolitan
4	*Allium sativum* L.	1000 m	Summer months	Barkaly	Cosmopoliton	Cosmopolitan
5	*Ixiolirion tataricum* (Pall.)	6200 ft	March-April	Tangai	Chitral, Swat, Kurram, Hangu, Quetta	Egypt, Turkey, Iran, Iraq, Afghanistan
6	*Narcissus tazetta* L.	5000 ft	April	Kharkhai	Quetta.	India, Afghanistan
7	*Arisaema flavum* (Forsk.) schot	1700-3000 m	June-July	Manzwala	West Himalaya	China, Afghanistan
8	*Asphodelus tenuifolius* Cav.	1900-2600 ft	November-April	Porykaly	Rawalpindi, Bahawalpur, Turbot	North Africa, India, Europe
9	*Eremurus himalaicus* Baker	11000 ft	May-September	Baja	Hazara, Kashmir, Chitral	Afghanistan, Tajikistan

Table 3: Phytodiversity among Colchicaceae, Commelinaceae, and Cyperaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering Session	Phytogeography		
				Study Area	Pakistan	World
1	*Colchicum luteum* Baker	1500-3000 m	February-May	Safaray	Himalayas	Central Asia, India,Afghanistan
2	*Commelina benghalensis* L.	3000 ft	June-September	Khaer	Hazara, Abbottabad, Mansehra, Swat, Balakot.	Asia and Africa
3	*Cyperus niveus Retz.*	1300-1900 m	April-June	Pano	Chitral, Dir, Swat, Balakot, Rawalpindi	India, Bengal, Africa
4	*Cyperus rotundus* L.	7000 ft	April-October	Anangoro	Gilgit, Chitral, Dir, Parachinar, Swat, Karachi	India

Table 4: Phytodiversity in Hyacinthaceae family.

Sr. No.	Botanical Name	Altitudinal Range	Flowering Session	Phytogeography		
				Study Area	Pakistan	World
1	*Scilla griffithii* Hochr.	4500 ft	March-April	Khawr	Kashmir, Chitral, Malakand, Dir, Swat	Afghanistan

Table 5: Phytodiversity in Iridaceae and Liliaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering Session	Phytogeography		
				Study Area	Pakistan	World
1	*Iris aitchisonii* (Baker) Boiss	900 m	March-April	Rashkhany	Swat, Dir, Malakand, Haripur, Rawalpindi, Hazara	Afghanistan
2	*Iris germanica* L.	5000 ft	April-May	Anarbagh	Chitral, Abbottabad	Germany
3	*Iris hookeriana* Foster	10000 ft	June-July	Laittai	Chitral, swat, Gilgit, Hazara	India
4	*Moraea sisyrinchium* (L.) Ker.	5500 ft	March-May	Safarai	Malakand agency, Dir, Swat, Peshawar, Kurram, Quetta	Europe, Egypt, Iraq, Iran, Libya
5	*Gagea elegans* Wall. ex Royle	13000 ft	April-July	Baja	Chitral, Hunza valley, Aran, Skardu	India, Nepal, China, Tajikistan
6	*Notholirion thomsonianum* (Royle)	10000 ft	April-May	Gut	Swat, Hazara Kashmir	India, Afghanistan
7	*Polygonatum verticillatum* All.	2600-4000 m	May-June	Barkaly	Chitral, Dir, Hazara, Swat	India, Nepal, Bhutan
8	*Tulipa stellata* Hk. f.	1000-3500 m	March-May	Zaim	Kashmir	Iran, India, Europe

Table 6: Phytodiversity in Poaceae family.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Apluda mutica* L.	7000 ft	August-November	Pano	Kashmir, KP, Sindh	Arabia, Australia
2	*Aristida adscensionis* L.	6000-7000 ft	March-December	Tangai	Gilgit, Punjab Kashmir, KP	middle East
3	*Aristida cyanantha* Nees ex Steud.	6500 ft	May-September	Khawr	Sindh, Punjab, KP, Baluchistan, Gilgit, Kashmir	India, Nepal, Afghanistan
4	*Arthraxon prionodes* (Steud.) Dandy	6-7000 ft	June-September	Banr safarai	-Do-	India, China, Thailand
5	*Avena fatua* L.	1700-2200 m	May-August	Barkaly	-Do-	North Africa
6	*Brachiaria ramosa* (L.) Stapf	5500 ft	July-October	Pano	-Do-	Senegal to Yemen, Africa
7	*Brachypodium sylvaticum* (Huds.) P. Beauv.	7000-8000 ft	June-September	Zaim	-Do-	Europe, Asia
8	*Bromus pectinatus* Thunb.	10000-12000 ft	April-August	Gut	-Do-	Egypt, Arabia, Iran, China, India
9	*Chrysopogon serrulatus* Trin.	4500 ft	August-September	Safari	-Do-	India, Nepal, Burma
10	*Cymbopogon commutatus* (Steud.) Stapf	4000-5000 ft	April-October	Barkley	-Do-	Arabia, Iraq, India
11	*Eragrostis minor* Host	8000 ft	May-September	Qalagai	-Do-	Warm and temperate region of the world
12	*Heteropogon contortus* (L.)	5000 ft	June-October	*Kharkai*	-Do-	Warm and temperate region of the world
13	*Setaria pumila* (Poir.) Roem. & Schult.	7500 ft	June-October	Khawr	-Do-	Tropical and warm temperate regions
14	*Sorghum halepense* (L.) Pers.	6000 ft	May-October	Kharkai	-Do-	Temperate regions
15	*Cynodon dactylon* (L.) Pers.	4500 ft	All year round	Khawr	Sindh, Punjab, KP, Baluchistan, Kashmir	Throughout the World
16	*Dactyloctenium aegyptium* (L.) Willd.	2500 ft	July-October	Zaim	-Do-	Warm and temperate region of the world

17	*Desmostachya bipinnata* (L.) Stapf	2000 ft	July-October	Khawr	-Do-	Middle East-Indo China
18	*Dicanthium annulatum* (Forssk.) Stapf	3000 ft	March-April	Barkaly	-Do-	Cosmopoliton
19	*Phalaris minor* Retz.	1700 m	March-May	Manzwala	-Do-	Throughout the world
20	*Poa annua* L.	1400-4300 m	March-September	Anangoro	-Do-	Cosmopolitan
21	*Setaria verticillata* (L.) P. Beauv.	4500 ft	Throughout much of the year	Safarai	-Do-	Tropical and warm temperate regions
22	*Themeda anathera* (Nees ex Steud.) Hack.	7500 ft	June-October	Rashkhany	-Do-	Afghanistan
23	*Digitaria abludens* (Roem. & Schult.) Veldk.	4500 ft	July-August	Khawr	Hazara, Abbottabad, Swat	Nepal, India to Thailand
24	*Lolium multiflorum* Lam.	160-2600 m	June-August	Barkaly	Baluchistan, KP	Europe, Africa, Asia
25	*Arundo donax* L.	4500 ft	June-December	Khawr	Punjab, KP, Baluchistan, Gilgit Kashmir	Burma, Africa

Table 7: Phytodiversity in Acanthaceae, Amaranthaceae and Anacardiaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering Session	Phytogeography		
				Study Area	Pakistan	World
1	*Dicliptera bupleuroides* Nees var.	4500 ft	June-October	Khawr	Baluchistan, Punjab, KP	Afghanistan, Nepal, India, China
2	*Justicia adhatoda* L.	1300 m	November-April (plain), July-October (hills)	Barkaly	Throughout the waste places	Indonesia, Malaya, India
3	*Achyranthes aspera L.*	4000 ft	May-June	Anangoro	Northern region of Pakistan	Warmer region of the world
4	*Amaranthus spinosus L.*	1210 m	May	Pano	Hazara, Haripur, Multan, Sialkot	Warmer region of the world
5	*Amaranthus viridis L.*	1220 m	April-August	Common weed of wastes	Pshawar, Nowshera, Hazara, Swat, Rawalpindi	Tropical & sub-tropical regions
6	*Celosia argentea L. var. cristata (L.) Schinz*	5000 ft	August-Sept	Barkaly	Hazara, Abbotabad, Swat, Gari Habibullah	Cosmopolitan
7	*Digera muricata (L.) Mart.*	1500 m	August-Sept	Porykaly	everywhere	Yemen to Afghanistan, India, Indonesia, Malaysia
8	*Pupalia lappacea (L.)* Juss.	1000 m	June	Qalagai	Malakand, Swat, Rawalpindi, Karachi	Arabia, India, Malaya, Indonesia
9	*Pistacia chinensis Bunge ssp. integerrima (J.L.S) Rech. f.*	457-1980 m	March-May	Tangai	-Do-	Afghanistan, North & west Himalaya

Table 8: Phytodiversity in Apiaceae, Apocinaceae, Araliaceae, Asclepiadaceae and Asteraceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering Season	Phytogeography		
				Study Area	Pakistan	World
1	*Coriandrum sativum* L.	3000 m	Early spring-Early summer	Kharkai	Cosmopolitan cultivated plant	Cosmopolitan
2	*Eryngium coeruleum* M-Bieb.	250 0m	Early summer	Safarai	Kohala, Muzaffarabad, Swat, Hazzara, Abbotabad	Russia, Turkey, Iran, Afghanistan, Tibet
3	*Foeniculum vulgare* Mill.	2000 m	March	Barkaly	Cosmopolitan	Cosmopolitan
4	*Scandix pecten-veneris* L.	2000 m	spring	Ziarat shah	Chitral, Hazara, Haripur, Rawalpindi, Quetta.	Europe, Asia, Australia, America
5	*Torilis japonica* (Houtt.) DC.	2500 m	April	Khawr	Hazara, Shogran, Swat, Peshawar	-Do-
6	*Torilis leptophylla* (L.)	4500 ft	May	Manzwala	Common	-Do-
7	*Nerium oleander* L.	5000 ft	April-October	Anangoro	Malakand, Dir,Hazara, Rawalpindi, Murree	China, Japan, Persia
8	*Trachelospermum lucidum* (D. Don) Schum.	5000 ft	April-July	Pano	Punjab, Kashmir, KP	Nepal
9	*Hedera nepalensis* K. Koch	1000-3000 m	October-April	Qalagai	himalayas	Asia, Japan, Afghanistan
10	*Calotropis procera* (Ait.) Ait. f.)	1800 m	All the year round	Porykaly	Kohot, Quetta, Sialkot, Hyderabad	India, Iran, Afghanistan
11	*Cynanchum jacquemon tiannum* Decne.	2170 m	July	Barkaly	Kashmir, Hazara, Swat	Afghanistan
12	*Periploca aphylla* Decne.	4500 ft	March-May	Tangai	Chitral, Swat, Murree ,Quetta, Karachi, Jhelum, Kurram	India, Iran, Iraq, Jordan, Arabia
13	*Vincetoxicum arnottianum* (Wight) wight	6000 ft	April-July	Rashkhany	Hazara, Kashmir, Malakand agency	West Pakistan
14	*Artemisia scoparia* Waldst	2200 m	July-November	Khawr	Balochistan, Punjab, KP	India, China, Russia
15	*Artemisia vulgaris* L.	6000-7000 ft	August-november	Zaim	Hazara, Neelam valley, Rawalpindi, Murree	Africa, Europe, India, Siberia, Iran
16	*Centaurea iberica* Trev. ex Spreng.	4500 ft	May	Barkaly	Dir, Swat, Chitral, Hazara, Baluchistan	Africa, India, China
17	*Cichorium intybus* L.	4000 ft	June	Pano	-Do-	-Do-
18	*Cirsium falconeri* (Hk. f.) Petrak	4000 ft	April-July	Khawr	-Do-	-Do-
19	*Cnicus benedictus* L.	4000 ft	April-July	Safaray	-Do-	-Do-
20	*Conyza Canadensis* (L.) Crongquist	4500 ft	May-August	Porykaly	-Do-	-Do-
21	*Echinops cornigerus* DC.	5000 ft	June	Qalagai	-Do-	-Do-
22	*Echinops echinatus* Roxb.	5000 ft	June	Khawr	-Do-	-Do-
23	*Eclipta prostrata* (L.) L.	5500 ft	June	Tangai	-Do-	-Do-
24	*Lactuca dissecta* D. Don	6000 ft	June	Barkaly	-Do-	-Do-
25	*Lactuca orientalis* Boiss.	6000 ft	June	Qalagai	-Do-	-Do-

26	*Lactuca serriola L.*	5000 ft	June	Ziarat shah	-Do-	-Do-
27	*Launaea procumbens* (Roxb.) Ramayya & Rajagopal	5500 ft	May-July	Barkaly	-Do-	-Do-
28	*Matricaria aurea* (L.) Schulz	5000 ft	May-July	Safaray	Kashmir, Punjab Chitral, Hazara	Europe, Africa Asia
29	*Pseudo gnaphalium affine* (D. Don.) Anderb.	2000 m	June	Porykaly	Chitral, Swat, Kashmir, Shikarpur, Dera Ismail Khan	India, Nepal, Africa
30	*Pseudo gnaphalium luteo-album* (L.)	2500 m	Almost throughout the year	Khawr	Dir, Swat, Chitral, Buner, Hazara, Kurram	India, China, Australia
31	*Seriphidium kurramense* (Qazilb.)	4000 ft	November-January	Barkaly	KP	India, China, Australia, Afghanistan
32	*Serratula palida* DC.	4000 ft	June	Safarai	Dir, Swat, Chitral, Buner, Hazara, Kurram	-Do-
33	*Silybum marianum* Gaertn.	5000 ft	June-July	Anangoro	-Do-	-Do-
34	*Solidago virga-aurea* L.	5500 ft	June-July	Khawr	-Do-	-Do-
35	*Sonchus arvensis* L.	5000 ft	April-May	Barkaly	-Do-	-Do-
36	*Sonchus asper* (L.) Hill	5000 ft	April-May	Porykaly	-Do-	-Do-
37	*Sonchus oleraceus* L.	5000 ft	April-May	Tangai	-Do-	-Do-
38	*Tagetes erecta* L.	4500 ft	March-April	Zaim	-Do-	-Do-
39	*Taraxacum officinale* Wigg.	6000 ft	All the year	Pano	-Do-	-Do-
40	*Tragopogon gracilis* D.Don	6000 ft	June-July	Safarai	-Do-	-Do-
41	*Xanthium strumarium* L.	4500 ft	June-July	Qalagai	-Do-	-Do-

Table: 9 Phytodiversity in Balsaminaceae, Berberidaceae and Betulaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Impatiens brachycentra Kar. & Kir.*	1900-3000 m	July-August	Khawr	Kashmir, Himalaya	Asia China
2	*Impatiens glandulifera* Royle	1600-4300 m	July-August	Tangai	Kashmir, Hazara, Naran, Haripur	Asia
3	*Berberis lycium* Royle	5000-6000 ft	April-June	Kharkai	Kashmir, Himalayas, Hazara, Malakand	
4	*Alnus nitida* (Spach) Endl.	1000-2900 m	Sep-Oct	Pano	Swat, Muzaffarabad, Mirpur	Temperate Himalayas

Table 10: Phytodiversity in Boraginaceae, Brassicaceae, Buddlejaceae, and Buxaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Buglossoides arvensis* (L.) Johnston	1400 m	March-April	Khawr	Chitral, Peshawar, Hazara, Abbotabad, Swat	Iraq, Afghanistan, Europe
2	*Cynoglossum lanceolatum* Forssk.	2500 m	June-August	Anangoro	Gilgit, Chitral, Swat, Hazara, Abbotabad, Waziristan, Murree	Arabia, Srilanka, Burma
3	*Heliotropium strigosum* Willd. ssp. brevifolium (Wall.) Kazmi	3000-4000 ft	July-September	Manzwal	Dir: Timergara, Gilgit, Hazara, Balakot, Rawalpindi, Islamabad	Nepal, Burma, Malaya
4	*Nonea caspica* (Willd.)	3000 ft	March-April	Barkaly	Swat, Dagar, Ziarat Quetta, Kalat	Iraq, Iran, Russia
5	*Nonea edgeworthii* A. DC.	2900 m	March-April	Safarai	Gilgit, Malakand, Rawalpindi, Sargodha, Mianwali	India, Malwa

6	*Onosma hispida* Wall. ex G. Don	1000-3400 m	May-June	Barkaly	Gilgit, Chitral, Hazara, Naran	Afghanistan
7	*Pseudomertensia parvifolia* (Decne.)	1500-2700 m	April-May	Porykaly	Gilgit, Chitral, Hazara, Naran	India
8	*Trichodesma indicum* (L.) R. Br.	1400 m	Throughout the year	Qalagai	Peshawar, Mardan, Abbotabad, Gujrat, Karachi	Afghanistan, India, Philliphine
9	*Alyssum desertorum* Stapf	3000-3300 m	March-June	Khawr	Chitral, Hazara, Swat, Rawalpindi, Baluchistan	Africa, Asia, Europe
10	*Capsella bursa-pastoris* (L.) Medik.	2700 m	March-June	Pano	Cosmopolitan	Europe
11	*Eruca sativa* Mill.	1350 m	April-June	Safarai	Chitral, Drosh, Punjab,Karachi	Europe, Africa, Asia
12	*Nasturtium officinale* R. Br.	2700 m	April-July	Qalagai	Chitral, Hazara, Kaghan, valley, Rawalpindi, Quetta	Europe, America
13	*Neslia apiculata* Fisch., CA.Mey. & Ave'-Lall	2100 m	March-April	Anangoro	Chitral, Hazara, aghan valley, Rawalpindi, Quetta	Europe, Africa, Asia
14	*Rorippa islandica* (Oed.) Borb.	6-7000 ft	April-July	Tangai	Chitral, Hazara, Kaghan Swat valley, Rawalpindi, Quetta	Europe, Denmark, Asia
15	*Buddleja crispa* Bth.	2500 m	April-May	Khawr	Baluchistan, KP	Afghanistan India
16	*Sarcococca saligna* (D. Don) Muell.-Arg.	3000 m	September-April	Kharkai	Himalayas	Afghanistan

Table 11: Phytodiversity in Campanulaceae, Cannabaceae, Cannaceae, Caprifoliaceae, Caryophyllaceae, Celastraceae, Chenopodiaceae, Convolvulaceae, Crassulaceae, Cucurbitaceae and Cuscutaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Opuntia dillenii* Haw.	4000 ft	April-may	Safaray	Gilgit, Chitral, Hazara,Naran	India, China
2	*Campanula pallida* Var	3100 m	April-July	Ziarat shah	Gilgit, Hunza, Swat, Kaghan	Afghanistan
3	*Cannabis sativa* L.	Plain to 10000 ft	April-September	Khawr	Northern parts	Russia, China, India, Iran
4	*Canna indica* L.	5000 ft	March-September	Tangai	Islamabad, Haripur, Karachi	America,Asia, West Indies
5	*Viburnum cotinifolium* D. Don	900-3500 m	March-May	Anarbagh	Swat, Chitral, Hazara, Kashmir, Kurram Agency, Murree hills	Afghanistan, Himalaya
6	*Silene conoidea* L.	1520-2130 m	March-April	Barkaly	Chitral, Gilgit, Swat, Rawalpindi, Quetta	Europe, Afrca, Arabica
7	*Silene vulgaris* (Moench) Garcke	1540-3048 m	June-July	Safaray	Chitral, Dir, Swat, Naran, Abbotabad, Babusar	-Do-
8	*Stellaria media* (L.)	13000 ft	April-August	Khawr	Cosmopolitan	Cosmopolitan
9	*Chenopodium album* L.	360-4330 m	January-September	Pano	Chitral, Gilgit, Babusar Valley, Kurram	Cosmopolitan
10	*Chenopodium ambrosioides* L.	1430 m	April-January	Safaray	Dir, Swat, Muzafferabad, Rawalpindi, Murree	America, Mexico
11	*Chenopodium botrys* L.	600-3700 m	April-August	Porykaly	Chitral, Timergara, Swat, Hazara, Besham, Abbotabad, Peshawar	Europe, Afrca, Arabica

12	*Convolvulus arvensis* L.	600-2500 m	All year	Rashkhany	Chitral. Gilgit, Peshawar, Parachinor, Rawalpindi	Temperate and tropical region of the world
13	*Ipomoea eriocarpa* R. Br.	5000 ft	August-October	Anangoro	Common in the plain and hills	Europe, Africa, Arabica
14	*Ipomoea purpurea (*L.) Roth.	2300 m	July-September	Pano	Swat, Hazara, Abbotabad, Murree, Quetta	America
15	*Rosularia adenotricha* (Wall.)	2000-4500 m	May-June	Banr safarai	Chitral, Swat, Hazara, Naran, Murree, Abbotabad	India, Nepal, Afghanistan
16	*Sedum hispanicum* L.	707-2000 m	March-June	Khawr	Swat,Chitral, and Shangla	Iraq, Iran, Russia
17	*Cucumis melo* L.	2000 ft	July-November	Tangai	Cultivated throughout Pakistan	Throughout the world
18	*Cucumis sativus* L.	1500 ft	All the year	Barkaly	Cultivated throughout Pakistan	Throughout the world
19	*Cucurbita maxima* Duch. Ex Lam.	2000 ft		Qallagai	Cultivated throughout Pakistan	Pakistan and India
20	*Lagenaria siceraria* (Molina)	1500 ft	March-May	Ziaratshah	Cultivated throughout Pakistan	Asia, Africa
21	*Luffa cylindrica* (L.)	2000 ft	April-October	Qallagai	Cultivated throughout Pakistan	Asia, Africa
22	*Luffa echinata* Roxb.	1500 ft	August-September	Khawr	Cultivated throughout Pakistan	India, Africa, Bangladesh

Table 12: Phytodiversity in Dipsacaceae, Ebenaceae, Euphorbiaceae, Fagaceae and Fumariaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Scabiosa candollei* DC.	1750-1900 m	April-August	Khawr	Dir, Peshawar, Hazara, Kaghan, Swat, Parachinar	Afghanistan
2	*Diospyros kaki* L.		Sep-Nov	Pano		Asia, Japan, China
3	*Diospyros lotus* L.	1500 m	May-June	Barkaly	Hazara, Swat, Muree, Kurram	India, China, Japan, Iran
4	*Andrachne cordifolia* (Wall.ex Dcne.) Muell. Arg.	700-2300 m	June-October	Manzwala	Gilgit, Chitral, Hazara, Kurram, Lahore, Bahawalpur	India, Nepal
5	*Chrozophora tinctoria* (L.) Raf.	275-2300 m	Jan:Sept	Anangoro	-Do-	Africa, Arabia, America
6	*Euphorbia cornigera* Boiss.	1000-3750 m	April: Sept	Anarbagh	Chitral, Dir, Hazara, Kaghan Valley, Muzafferabad, Rawalpindi, Murree	India
7	*Euphorbia helioscopia* L.	200-2000 m	Jan-July	Tangai	Gilgit, Chitral, Hazara, Swat, Kurram, Lahore, Bahawalpur	Europe, Africa, Asia, America
8	*Euphorbia hirta* L.	1370 m	July-December	Safaray	Gilgit, Chitral, Swat Hazara, Kurram, Lahore, Bahawalpur	India
9	*Euphorbia indica* Lam.	1524 m	Feb-May	Barkaly	Gilgit, Chitral, Swat, Hazara, Kurram, Lahore, Bahawalpur	Africa, Arabia, India, China, Afghanistan, Iran
10	*Euphorbia prostrata* Ait.	518-1800 m	Throughout the year	Porykaly	Gilgit, Chitral, Hazara, Kurram, Lahore, and Bahawalpur	America
11	*Ricinus communis* L.	4000 ft	At most seasons	Qallagai	Kohat, Rawalpindi. Makran, Karachi, Waziristan	Africa, southern Europe
12	*Quercus baloot* Griffth.	1800-3000 m	April-May	Rashkhany	Kashmir	Afghanistan
13	*Quercus incana* Roxb.	1000-2700 m	April-May	Anangoro	Himalayas	Nepal, Burma
14	*Fumaria indica* (Hausskn.) Pugsley	900-2100 m	March-June	Banr safarai	Swat, Hazara, Kashmir, Peshawar, D.I Khan, Rawalpindi, Islamabad, Lahore, Khairpur, Hayderabad, Karachi, Baluchistan	India, Asia, Afghanistan, Central introduced elsewhere

Acanthaceae, Alismataceae, Amaryllidaceae, Apocyanaceae, Asphodelaceae, Crassulaceae, Nyctaginaceae, Primulaceous, Thymeleaceae, Urticaceae, and Verbenaceae were bigeneric (0.787402%) and bispecific (0.60241%). Alliaceae, Balsiminaceae, Cyperaceae, Ebenaceae, Fagaceae, Plantiginacea, Smilacaceae, Ulmaceae, Violaceae, and Vitaceae had 1 genus (0.393701%) and 2 species (0.60241%) each. Anacardiaceae, Araceae, Araliaceae, Berberidaceae, Betulaceae, Buddlejaceae, Buxaceae, Cactaceae, Campanulaceae, Cannabaceae, Cannaceae, Caprifoliaceae, Celastraceae, Colchicaceae, Commelinaceae, Cuscutaceae, Datiscaceae, Dipsacaceae, Fumariaceae, Juglandaceae, Hamamelidaceae, Hyacinthaceae, Hypericaceae, Malvaceae, Meliaceae, Mimisaceae, Molluginaceae, Myrsinaceae, Myrtaceae, Oleaceae, Onagraceae, Oxalidaceae, Paeoniaceae, Papaveraceae, Platanaceae, Plumbiginaceae, Portulacaceae, Punicaceae, Rutaceae, Sapindaceae, Sapotaceae, Saxifragaceae, Simaroubaceae, Tilliaceae and Zygophyllaceae had 1 genus (0.393701%) and 1 species (0.301205%) each as shown in Tables 13, 14, 15,16, 17, and 18.

Table 19 presents numerical analyses related to the phytodiversity of angiosperms, specifically focusing on the families Alismataceae, Alliaceae, Amaryllidaceae, Areaceae, and Asphodelaceae. It likely includes quantitative data such as species richness, abundance, distribution patterns, or other numerical measures relevant to the study of plant diversity within these families.

Plants resource utilization or simply ethnobotany is the study of the interaction between plants and peoples with a special attention on old tribal cultures (Mesfin et al*.,* 2013). Human relations with plants fluctuate due to their uses, comparative importance, and varying social, cultural, and indigenous aspects. Similarly, the ethnobotanical information helps ecologists, pharmacologists, taxonomists, and wildlife directors in their efforts to clarify the wealth of the area (Ibrar et al., 2007).

Phytodiversity refers to the number and type of plant species in a specific geographic area (Kunwar, 2011). Pakistan is rich in biodiversity with a total of 6000 reported plant species (Islam et al., 2021. These plant species have been used for food, medicine, animal fodder, construction, fibers, firewood, ritual, and ornamental purposes since unknown times. In addition, these plants have a strong influence on ecosystems and play an important role in the socioeconomic development of the country (Qureshi et al., 2014). In such conditions, the study of phytodiversity or biodiversity is important for the stability and proper functioning of the ecosystem. The loss of biodiversity significantly affects the stability and functioning of the ecosystem and ultimately results in loss of habitat, deforestation, pollution, extinction of indigenous species, and introduction of new species (Kulkarni et al., 2011). Hence, it demands to conservation of biodiversity for sustainable utilization of plant resources. The current research provides first-hand information about the flora and vegetation of the Siyar Dara.

The interaction between plants and human cultures is infinite in to use of plants for food, clothing, and shelter but also includes their use for religious rituals, ornamentation, and health care (Brett, 1994). They proposed that ethnobotanists should attempt to explain deep understandings of plant life and plant relationships as comprehended by the indigenous peoples. These interactions can be social, economic, religious, symbolic, commercial, and creative (Aumeeruddy et al., 2003; Humayun, 2005).

Nowadays phytodiversity requires botanical training for the identification and preservation of plant specimens, anthropological training to understand the cultural concepts around the perception of plants, and linguistic training, at least enough to transcribe local terms and native because the native healers are often hesitant to accurately share their knowledge to outsiders (Gerique, 2006). In addition to these essential forms of training, it is also crucial to foster strong relationships with local communities and indigenous peoples. Building trust and mutual respect is paramount in gaining valuable insights into traditional plant knowledge and medicinal practices. Collaboration and partnership with native healers and elders can lead to a deeper understanding of the intricate connections between people, plants, and the environment. By working together in a spirit of cooperation and shared learning, we can help safeguard phytodiversity for future generations to come (Qureshi et al., 2014).

Plants play an essential role in the treatment of diseases and remain the best alternative for a large majority of people (Togola et al., 2005). A total of 90 plants were found to be used for various purposes locally. Out of 90 plants, 25 (27.7%) were medicinal, 23 (25.5%) were used as fodder, 15 (16.6%) were used for miscellaneous purposes, 10 (11.1%) were used as fuelwood, 8 (8.8%) were used as timber, 8 (8.8%) were common vegetables and 1 plant was used for ornamental purposes.

Table 13: Phytodiversity in Geraniaceae, Hamamelidaceae, Hypericaceae and Juglandaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/ Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Erodium ciconium* (L.)	5000 ft	March-April	Kharkai	Swat, Kalachitta Hills, Kohat, Dera Adam Khail	Cyprus, Australia, Africa, Turkey, Iran, Asia
2	*Erodium cicutarium* (L.) L' Herit ex Aiton	700-2400 m	March-April	Khawr	Chitral, Gilgit, Kurram, Parachinor, Torkham, Quetta.	Europe, Africa, Asia, Arabia
3	*Geranium collinum* Stapf. ex Willd.	2800-4800 m	July-August	Tangai	Himalayas	Russia, Turkey, Iran, Asia
4	*Geranium lucidum* L.	2000-3000 m	April-May	Manzwala	Murree, Himalayas	Africa, Turkey, Iran, Afghanistan
5	*Geranium ocellatum* Camb.	1000-2400 m	March-April	Anarbagh	Swat, Hazara, Kashmir	Africa, Afghanistan
6	*Geranium rotundifolium* L.	3000 m	March-April	Pano	Chitral, Drosh, Swat, Peshawar, Attock, Rawalpindi, Baluchistan, Hassanabdol	Europe, Turkey, Iran
7	*Parrotiopsis jacquemontiana* (Dcne.)	1200-2800 m	March-May	Khawr	Murree, Hazara. Swat, Kurram	India, China, Afghanistan
8	*Hypericum perforatum L.*	1200-3000 m	June-Sept	Barkaly	Chitral, Swat, Hazara, Murree, Kaghan Valley, Buni, Kurram Valley	Europe, China, Africa, America

Table 14: Phytodiversity in Lamiaceae family.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/ Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Ajuga bracteosa* Wall. ex Bth.	2200 m	March-December	Barkaly	Kashmir, Himalayas	Afghanistan, Burma, China, Bhuton
2	*Clinopodium umbrosum* (M. Bieb.) C. Koch.	2130 m	May-July	Porykaly	Chitral, Swat, S hangla, Murree, Abbotabad, RAwalpindi	Turkey, Iran, Afghanistan
3	*Eremostachys superba* Royle ex Bth.	1370 m	March-April	Pano	Chitral, Swat	Afghanistan, India
4	*Isodon rugosus (*Wall. ex Bth.)	2300 m	March-October	Qallagai	Gilgit, Chitral, Kalam, Hazara, Razmak., Rawalpindi, Skardu	Arabia, Nepal, China
5	*Lamium album* L.	3500 m	June-September	Anangoro	Gilgit, Chitral, Hazara, Kurram, Rawalpindi, Kashmir.	Europe, Asia
6	*Lamium amplexicaule* L.	3960 m	December-April	Tangai	Chitral, Swat, Kurram, Quetta, Sargodha	Europe, Asia
7	*Leonurus cardiaca* L.	2000 m		Khawr		Asia
8	*Marrubium vulgare* L.	1400 m	April-June	Safarai	Chitral, Swat, Kurram, Waziristan	Europe, Asia,
9	*Mentha arvensis* L.	2400 m	July-Sept	Barkaly	Kashmir, Muzaffarabad, and Leepa valley	Asia
10	*Mentha longifolia*	3300 m	May-Nov	Manzwala	Kaghan, Chitral, Hazara, Kurram, khuzdar	Europe, Asia
11	*Micromeria biflora* (Buch. - Ham.ex D. Don) Bth.	2400 m	Almost all the year	Pano	Kashmir	Afghanistan, India, China
12	*Nepeta raphanorhiza* Benth.	2200 m	April-June	Barkaly	Chitral, Swat, Shangla, Kurram	Afghanistan, India

13	*Origanum vulgare* L.	2750 m	June-Oct	Tangai	Chitral, Swat, Malakand, Kalam, Shogran, Abbotabad, Rawalpindi	Europe Asia, China and Taiwan
14	*Otostegia limbata* (Bth.)	2000 m	April-May	Qalagai	Dir, Swat, Hazara, Balakot, Parachinor,	Endemic
15	*Phlomis spectabilis* Falc. ex	2130 m	July-Sept	Zaim	Chitral, Swat, Kurram, Rawalpindi, Quetta	Afghanistan, Nepal
16	*Salvia moorcroftiana* Wall.	3000 m	April-June	Khawr	Himalayas, kashmir	Afghanistan, Nepal
17	*Salvia nubicola* Wall. ex Sweet	3000 m	June-Oct	Safarai	Chitral, Gilgit, Hazara, Kaghan valley, Kurram, Quetta.	Afghanistan, India, Nepal, Bhuton
18	*Salvia plebeia* R. Br.	1830 m	March-June	Qalagai	Himalayas, Kashmir, Hazara, Chitral, Shangla, Swat, Karachi	India, China, Japan, Australia
19	*Stachys emodi* Hedge	3350 m	June-August	Barkaly	Gilgit, Hazara, Abbotabad, Shogran. Dir.	Afghanistan, India, Bhuton
20	*Stachys parviflora* Bth.	1700 m	May-June	Laittai	Khyber agency, Swat, Waziritan, Quetta, Rawalpindi	Afghanistan, India

Table 15: Phytodiversity in Linaceae, Malvaceae, Meliaceae, Mimosaceae, Molluginaceae, Moraceae, Myrsinaceae, Myrtaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/ Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Linum corymbulosum* Reichenb.	2300 m	March-June	Kharkai	W. Pakistan	Africa, Afghanistan India
2	*Reinwardtia trigyna* (Roxb.) Planch.	2300 m	Feb-May	Tangai	N.W Himalayas	Africa, Afghanistan, India
3	*Malva neglecta* Wall.	14000 ft	April-May	Baja	Plains, Gilgit, Chitral, Hazara, Kurram, Babosar Villages, Lalazar	America
4	*Melia azedarach* L.	1700 m	March-April	Ziaratshah	Rawalpindi, Baluchistan, Karachi	China, Burma, Turkey, India
5	*Mimosa himalayana* Gamble	1050 m	June-August	Khawr	Swat, Hazara, Kashmir, Rawalpindi,	India, Sikkim, Afghanistan
6	*Mollugo nudicaulis* Lamk.	1500 m	Oct-November	Anangoro	Dir, Swat, Abbotabad, Kashmir	America, Africa, India
7	*Ficus carica* L. ssp carica	2200 m	April-December	Pano	Dir, Swat, Abbotabad, Kashmir	India, Russia, Africa, Europe
8	*Ficus palmata* Forssk.	2500 m	May-November	Manzwala	Gilgit, Chitral, Dir, Mardan, Shangla, Rawalpindi,	Nepal, India, Iran, Afghanistan, Ethiopia, Sudan
9	*Ficus sarmentosa* Buch. Ham. ex J.E. Smith	2300 m	May-September	Porykaly	Kashmir, Gilgit, Chitral, Dir, Mardan, Shangla, Rawalpindi	India, Burma, China, Bangladesh
10	*Morus alba* L.	3500 m	April-September	Tangai	Gilgit, Chitral, Dir, Mardan, Shangla, Rawalpindi	Japan,China, Malaya, Burma
11	*Morus macroura* Miq.	2000 m	March-April	Khawr	Rawalpindi, Lahore	India, Nepal, China
12	*Morus nigra* L.	2200 m	March-July	Safarai	Gilgit	Africa, America, Central Asia
13	*Myrcene africana* L.	1500 m	March-May	Barkaly	Chitral, Murree, Rawalpindi, Hazara	Asia, Africa
14	*Myrcene africana* L.	1500 m	March-May	Barkaly	Chitral, Murree, Rawalpindi, Hazara	Asia, Africa

Table 16: Phytodiversity in Nyctaginaceae, Oleaceae, Onagraceae, Oxalidaceae, Paeoniaceae, Papaveraceae and Papilionaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/ Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Boerhavia procumbens* Banks ex Roxb.	2200 m	Sept-August	Anangoro	Dir, Swat, Kaghan, Rawalpindi, Parachinor, Baluchistan, Karachi	Asia, India
2	*Mirabilis jalapa* L.	2000 m	Sept-October	Safarai	Hazara, Kohot, Rawalpindi, Quetta	America
3	*Olea ferruginea* Royle	500-2000 m	April-September	Pano	Swat, Chitral, Malakand Agency, Hazara, Khyber Agency, Jhelum	Afghanistan, Kashmir
4	*Oenothera rosea* L' Her. Ex Ait.	600-2700 m	April-September	Barkaly	Swat, Dir, Hazara, Kurram Agency, Murree Hills, Sargodha, DG Khan	Nativa of USA (Texas), Central and S. America
5	*Oxalis corniculata* L.	2700 m	March-Sept	Khawr	Cosmopoliton weed	Cosmopoliton weed
6	*Paeonia emodi* Wall.	3200 m	May-June	Tangai	Himalayas, Chitral	India, Afghanistan.
7	*Papaver pavoninum*	1400 m	April-June	Kharkai	Chitral, Swat, Kurram, Rawalpindi	Turcomania, Iran, Altai, Afghanistan
8	*Astragalus leucocephalus* Grah.	7000 ft	March- June	Anangoro	Punjab, KP	India, Afghanistan
9	*Astragalus grahamianus*	8000-9000 ft	April- August	Zaim	Landi Kotal, Hazara, Kaghan, Naran	Afghanistan, India
10	*Astragalus pyrrhotrichus* Boiss.	4000 ft	March- Sept	Gut	Khyber Pass, Abbotabad, Swat, Hazara	Afghanistan,In dia
11	*Desmodium elegans* DC.	7500 ft	June-Sept	Khawr	Sindh Valley, Kurram Valley, Dir, Swat, Hazara, razmak	India, Nepal, Bhutan
12	*Indigofera heterantha* Wall.	6000 ft	May-July	Safarai	Swat, Nathiagali, Lalazar, Kalam	India, Nepal, Bhutan, Afghanistan

Table 17: Phytodiversity in Rhamaceae, Rosaceae and Rubiaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/ Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Sageretia thea* (Osbeck) M.C. Johnston	6000 ft	July-Sept	Safarai	Hazara, Swat, Hunza, Naushera	India, Iran, China, Nepal, Arabia, Afghanistan
2	Ziziphus nummularia	3000 ft	March-June	Porykaly	Malakand, Peshawar, Attock, Karachi	India, Iran, China, Nepal, Arabia, Afghanistan.Iraq
3	*Ziziphus jujuba* Mill.	5000 ft	June-July	Pano	Hazarat, Mansehra, Abbotabad	India, Iran, China, Nepal, Arabia, Afghanistan, Japan
4	*Ziziphus oxyphylla* Edgew.	4000-7000 ft	June-Sept	Tangai	Punjab, KP	India
5	*Cotoneaster nummularia* Fisch.	3000 ft	March-April	Khawr	Dir, Swat, Chitral	Europe, Asia, America

6	*Duchesnea indica* (Andr.) Focke	5000 ft	March-Oct	Manzwala	Chitral, Dir, Punjab	India, Iran, China, Nepal, Arabia, Afghanistan, Korea, Africa
7	*Potentilla supina* L.	2400 m	Feb-March	Khawr	Baluchistan, Kashmir	Afghanistan,Turkey, China
8	*Fragaria nubicola* Lindl. ex Lacaita	1500-3600 m	May-Aug	Barkaly	Babusar, Gilgit, Muzafferabad, Shangla, Kohot, Kurram.	Afghanistan, China, Bhutan, Nepal, Sikkim
9	*Geum elatum* G.Don	2000 ft	April-May	Pano	Dir, Swat, Chitral	-Do-
10	*Malus pumila* Mill.	2300 ft	April-May	Barkaly	Dir, Swat, Chitral	-Do-
11	*Prunus armeniaca* L.	2500 ft	Feb-March	Qallagai	Dir, Swat, Chitral	-Do-
12	*Prunus domestica* L.	2500 ft	Feb-March	Anangoro	Dir, Swat, Chitral	-Do-
13	*Prunus persica* (L.) *Batsch.*	2400 ft	Feb-March	Banrsafarai	Dir, Swat, Chitral	-Do-
14	*Pyrus pashia* Ham. ex D. Don	2400 ft	Feb-March	Kharkai	Dir, Swat, Chitral	-Do-
15	*Rosa alba* L.	2400 ft	March-April	Ziarat shah	Common	Afghanistan, Turkey, China.
16	*Rosa brunonii* Lindl.	7000-8000 ft	June-July	Zaim	Chitral, Hazara, Murree, Galyat, Islamabad, Abbotabad, Swat, Shangala	Poland
17	*Galium aparine* L.	3500 m	March-July	Manzwala	Swat, Hazara, Gilgit, Peshawar, Khyber Agency, Kurram Agency, Rawalpindi, Lahore, Baluchistan	Europe, N. Africa, Iran, Afghanistan, India
18	*Himalrandia tetrasperma* (Roxb.) Yamazaki	2000 m	May-June	Safarai	Swat, Hazara, Kashmir, Peshawar, Khyber Agency	Himalaya, India, Kashmir, Nepal, Bhutan
19	*Rubia cordifolia* L.	1800-2300 m	June-November	Qallagai	Hazara, Swat, Gilgit, Baltistan, Kashmir, Kurram Agency, Murree hills, Baluchistan	Greece, N. Africa, India, Kashmir, Nepal, Bhutan, China

Table 18: Phytodiversity in Scrophulariaceae, Solanaceae, Thymeleaceae, Verbenaceae, Vitaceae, Violaceae and Zygophyllaceae families.

Sr. No.	Botanical Name	Altitudinal Range	Flowering/Fruiting phenology	Phytogeography		
				Study Area	Pakistan	World
1	*Kickxia ramosissima* (Wall.) Janchen	3000 ft	May-June	Kharkai	Dir, Swat, Chitral	Australia, Africa, America, China, India
2	*Mazus japonicus* (Thunb.) O. Ktze	4000 ft	May-June	Anangoro	-Do-	-Do-
3	*Scrophularia scabiosifolia* Bth.	2500 ft	April-May	Khawr	-Do-	-Do-
4	*Scrophularia striata* Boiss.	3000 ft	April-May	Safarai	-Do-	-Do-
5	*Verbascum erianthum* Bth.	2500 ft	April-May	Barkaly	-Do-	-Do-
6	*Verbascum thapsus* L.	3000 ft	April-June	Manzwala	-Do-	Africa, America, China,
7	*Veronica biloba* L.	2500 ft	April-June	Porykaly	-Do-	-Do-
8	*Veronica anagallis*-aquatica	3000 ft	April-June	Qallagai	-Do-	-Do-
9	*Wulfenia amherstiana* Wall. ex Bth.	2500 ft	April-June	Pano	-Do-	-Do-

10	*Capsicum frutescens* L.	1900 m	April-May	Pano	Hazara, Islamabad,	America. India
11	*Datura anoxia* Mill.	1524 m	May-October	Kharkai	Peshawar, Malakand, Attockdist, Rawalpindi, Murree, Sialkot, Quetta	Afghanistan, USA, India, malaysia
12	*Datura stramonium* L.	914-2286 m	June-July	Barkaly	Chitral, Gilgit, Muzafferabad, Balakot, Babosar	
13	*Hyoscyamus niger* L.	9000 ft	June-July	Zaim	Chitral, Kurram agency, Hazara, Swat, Kashmir, Muzafferabad	N. America, N.Africa, Iraq, Iran, Afghanistan
14	*Lycopersicon esculentum* Miller	3000 ft	July-October	Anarbagh	Peshawar, Chitral, Dir, Swat, Charsada, Kohot	America
15	*Physalis divaricata* D. Don	610-981 m	August-Oct	Manzwala	-Do-	Afghanistan, Nepal
16	*Solanum nigrum* L. *var. nigrum*	3000 ft	All the year	Tangai	-Do-	Cosmopoliton
17	*Solanum nigrum* L. var. vilosum *L.*	3000 ft	March-April	Ziaratshah	-Do-	Afghanistan, Nepal
18	*Solanum surattense* Burm. f.	1300 m	All the year	Khawr	-Do-	Africa, Asia, Australia
19	*Withania somnifera* (L.) Dunal	2300 m	Throughout the year	Rashkhany	-Do-	Africa, Iraq, Iran, Turkey, Syria, Palestine, Arabia
20	*Daphne mucronata* Royle	800-3000 m	April-Sept	Kharkai	Hazara, Kaghan, Poonch	Iran, Africa, Europe, Afghanistan
21	*Wikstroemia canescens* Meisn.	1000-2900 m	June-Sept	Barkaly	Hazara,Swat	Nepal, China, Afghanistan
22	*Verbena officinalis* L.	500-2000 m	June-Dec	Safarai	Dir, Swat, Chitral	Europe, Asia, Africa,
23	*Vitex negundo* L.	4000 ft	Round the year	Rashkhany	Dir, Swat, Chitral	Asia, Africa, India
24	*Vitis jacquemontii* Parker	4500 ft	March-April	Banr safarai	Himalayas	India
25	*Vitis vinifera* L.	4000 ft	May-July	Tangai	Swat, Chitral, Kashmir, Baluchistan	Iran, China, Japan, Europe, Africa
26	*Viola betonicifolia* Sm.	4000 ft	May-August	Pano	Dir, Swat, Chitral	India, Nepal, Burma, China, Japan
27	*Viola canescens* Wall.	3500 ft	March-June	Porykaly	Dir, Swat, Chitral	India, Nepal, Bhutan
28	*Tribulus terrestris* L.	3500 m	All the year	Qallagai	Hazara, Chitral, Swat	Australia, Asia, Africa, Europe

Ajuga bracteosa, *Artemisia scoparia*, *Aconitum heterophyllum*, *Paeonia emodi,* and *Colchicum luteum,* etc. were common medicinal plants. Common fodder plants are *Avena fatua*, *Calendula arvensis*, *Otostegia limbata* and *Sonchus asper,* etc. *Cannabis sativa*, *Chenopodium album*, *Ficus carica*, *Myrtus communis*, *Monotheca buxifolia* etc. were used for more than one purpose. *Dodonea viscosa*, *Olea ferruginea*, and *Isodon rugosus* etc. were commonly used for burning and as fuelwood. *Abies pindrow*, *Pinus roxburghii*, *Morus alba* and *Melia azedarach,* etc. were common timber plants. *Allium cepa*, *Allium sativum*, *Cucumis sativus*, *Nasturtium officinale,* and *Malva neglecta,* have been used traditionally to treat various health issues, including coughs, colds, and respiratory infections due to their expectorant and antimicrobial properties. They are also believed to have anti-inflammatory effects and may help reduce inflammation in conditions like arthritis. Some studies suggest that have antioxidant properties and could contribute to overall heart health.

Table 19: Numerical analyses of flora of Khall Hagram Dara, Lower Dir, Khyber Pakhtunkhwa, Pakistan.

Sr. No.	Family	Number of Genera	Number of Species	% Age of genera	% Age of species	Generic coefficient per family
1	Acanthaceae	2	2	0.787402	0.60241	1
2	Alismataceae	2	2	0.787402	0.60241	1
3	Alliaceae	1	2	0.393701	0.60241	2
4	Amaranthaceae	5	6	1.968504	1.807229	1.2
5	Amaryllidaceae	2	2	0.787402	0.60241	1
6	Anacardiaceae	1	1	0.393701	0.301205	1
7	Apiaceae	5	6	1.968504	1.807229	1.2
8	Apocynaceae	2	2	0.787402	0.60241	1
9	Araceae	1	1	0.393701	0.301205	1
10	Araliaceae	1	1	0.393701	0.301205	1
11	Asclepiadaceae	4	4	1.574803	1.204819	1
12	Asphodelaceae	2	2	0.787402	0.60241	1
13	Asteraceae	23	30	9.055118	9.036145	1.304348
14	Balsaminaceae	1	2	0.393701	0.60241	2
15	Berberidaceae	1	1	0.393701	0.301205	1
16	Betulaceae	1	1	0.393701	0.301205	1
17	Boraginaceae	7	8	2.755906	2.409639	1.142857
18	Brassicaceae	6	6	2.362205	1.807229	1
19	Buddlejaceae	1	1	0.393701	0.301205	1
20	Buxaceae	1	1	0.393701	0.301205	1
21	Cactaceae	1	1	0.393701	0.301205	1
22	Campanulaceae	1	1	0.393701	0.301205	1
23	Canabaceae	1	1	0.393701	0.301205	1
24	Cannaceae	1	1	0.393701	0.301205	1
25	Caprifoliaceae	1	1	0.393701	0.301205	1
26	Caryophyllacea	3	4	1.181102	1.204819	1.333333
27	Celastraceae	1	1	0.393701	0.301205	1
28	Chenopodiaceae	1	4	0.393701	1.204819	4
29	Colchicaceae	1	1	0.393701	0.301205	1
30	Commelinaceae	1	1	0.393701	0.301205	1
31	Convolvulaceae	2	3	0.787402	0.903614	1.5
32	Crassulaceae	2	2	0.787402	0.60241	1
33	Cucurbitaceae	5	8	1.968504	2.409639	1.6
34	Cupresaceae	2	2	0.787402	0.60241	1
35	Cuscutaceae	1	1	0.393701	0.301205	1
36	Cyperaceae	1	2	0.393701	0.60241	2
37	Datiscaceae	1	1	0.393701	0.301205	1
38	Dipsacaceae	1	1	0.393701	0.301205	1
39	Ebenaceae	1	2	0.393701	0.60241	2
40	Euphrbiaceae	4	8	1.574803	2.409639	2
41	Fagaceae	1	2	0.393701	0.60241	2
42	Fumariaceae	1	1	0.393701	0.301205	1
43	Geraniaceae	2	4	0.787402	1.204819	2
44	Hamamelidaceae	1	1	0.393701	0.301205	1
45	Hyacinthaceae	1	1	0.393701	0.301205	1
46	Hypericaceae	1	1	0.393701	0.301205	1
47	Iridaceae	2	4	0.787402	1.204819	2
48	Juglandaceae	1	1	0.393701	0.301205	1
49	Lamiaceae	16	22	6.299213	6.626506	1.375
50	Liliaceae	4	4	1.574803	1.204819	1
51	Linaceae	2	2	0.787402	0.60241	1

52	Malvaceae	1	1	0.393701	0.301205	1
53	Meliaceae	1	1	0.393701	0.301205	1
54	Mimosaceae	1	1	0.393701	0.301205	1
55	Molluginaceae	1	1	0.393701	0.301205	1
56	Moraceae	2	6	0.787402	1.807229	3
57	Myrsinaceae	1	1	0.393701	0.301205	1
58	Myrtaceae	1	1	0.393701	0.301205	1
59	Nyctaginaceae	2	2	0.787402	0.60241	1
60	Oleaceae	1	1	0.393701	0.301205	1
61	Onagraceae	1	1	0.393701	0.301205	1
62	Oxalidaceae	1	1	0.393701	0.301205	1
63	Paeoniaceae	1	1	0.393701	0.301205	1
64	Papaveraceae	1	1	0.393701	0.301205	1
65	Papilionaceae	12	20	4.724409	6.024096	1.666667
66	Pinaceae	3	4	1.181102	1.204819	1.333333
67	Plantaginaceae	1	2	0.393701	0.60241	2
68	Platanaceae	1	1	0.393701	0.301205	1
69	Plumbaginaceae	1	1	0.393701	0.301205	1
70	Poaceae	24	25	9.448819	7.53012	1.041667
71	Polygalaceae	1	1	0.393701	0.301205	1
72	Polygonaceae	5	9	1.968504	2.710843	1.8
73	Portulaceae	1	1	0.393701	0.301205	1
74	Primulaceae	2	2	0.787402	0.60241	1
75	Punicaceae	1	1	0.393701	0.301205	1
76	Ranunculaceae	5	9	1.968504	2.710843	1.8
77	Rhamnaceae	2	4	0.787402	1.204819	2
78	Rosaceae	10	14	3.937008	4.216867	1.4
79	Rubiaceae	3	3	1.181102	0.903614	1
80	Rutaceae	1	1	0.393701	0.301205	1
81	Salicaceae	2	3	0.787402	0.903614	1.5
82	Sapindaceae	1	1	0.393701	0.301205	1
83	Sapotaceae	1	1	0.393701	0.301205	1
84	Saxifragaceae	1	1	0.393701	0.301205	1
85	Scrophulariaceae	6	9	2.362205	2.710843	1.5
86	Simaroubaceae	1	1	0.393701	0.301205	1
87	Smilaceae	1	2	0.393701	0.60241	2
88	Solanaceae	7	10	2.755906	3.012048	1.428571
89	Thymelaeaceae	2	2	0.787402	0.60241	1
90	Tiliaceae	1	1	0.393701	0.301205	1
91	Ulmaceae	1	2	0.393701	0.60241	2
92	Urticaceae	2	2	0.787402	0.60241	1
93	Valerianaceae	2	3	0.787402	0.903614	1.5
94	Verbenaceae	2	2	0.787402	0.60241	1
95	Violaceae	1	2	0.393701	0.60241	2
96	Vitaceae	1	2	0.393701	0.60241	2
97	Zygophylaceae	1	1	0.393701	0.301205	1
		254	354	100	100	
	Generic Index= Number of Species/ Number of Genera					
	= 332/254					
	= 1.30					

CONCLUSIONS

A total of 332 species of spermatophytes, belonging to 97 families, were collected from Hall Dara. In monocots, Poaceae was the largest family, having 24 genera and 25 species. In dicots, Asteraceae was the largest family, consisting of 23 genera and 30 species. The generic

index was 1.30, which clearly showed tremendous ecological and floristic diversity in Hall Dara. A total of 90 plants were found to be used for various purposes locally. Out of these 90 plants, 25 were medicinal, 23 were used as fodder, 15 were used for miscellaneous purposes, 10 were used as fuelwood, 8 were used as timber, 8 were common vegetables, and 1 plant was used for ornamental purposes.

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AUTHORS' CONTRIBUTIONS

SU and LS conceptualized the study design and research objectives; GS and MS analyzed and interpreted the botanical data; RB and YK were involved in fieldwork planning and logistics; UG contributed to the literature review and background research; SA and ZK wrote the paper; SU proofread the manuscript.

CONFLICT Of INTEREST

The authors declare no conflict of interest.

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