

## Eco-Taxonomic Study of Family Poaceae (Gramineae)

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## ABSTRACT

**Background:** The study of species diversity, its conservations and extinction can be done by using systematics in plant biodiversity. Poaceae is a very diverse grass family with great economic importance as it contains crops like rice, maize, oats, wheat, etc.

**Objectives:** The current study was undertaken in district Charsadda during 2017-18 in flowering season to collect different grass species from the area.

**Methodology:** Grass specimens were gathered, preserved, mounted and then identified from the available literature/native flora (Flora of Pakistan). Ecological parameters like habitat, class, life cycle and biological spectra were determined. A total of 51 taxa comprised of 34 genera, 5 subfamilies and 11 tribes of grasses were collected from the District Charsadda. The subfamily Panicoideae was the leading family with highest number of genera, taxa and tribes, followed by Pooideae.

**Results:** The biological spectrum showed that in the life-form class, Therophyte had the highest number of species 32 (62.74%), followed by Hemicryptophyte having 13 species (25.49%). In the Leaf size class, microphylls were dominant with 24 species (47.05%) followed by nanophylls having 14 species (27.45%). The adaptational survival of plants showed that 32 species (62.74%) were terrestrial and 19 species (37.25%) were amphibious in our study. The Life-cycle class depicted that 33 species (64.70%) were annual, 17 species (33.33%) were perennial and 1 species (1.960%) was annual or perennial. The Palatability class showed that 35 species (68.62%) were highly palatable, followed by less-palatable 11 species (21.56%), non-palatable 2 species (3.921%) and moderately palatable 3 species (5.882%). The Abundant class were determined through species rating scale in ecology ACFOR (Abundant Common Frequent Occasional Rare) scale to describe species abundance in a given area; 26 species (50.98%) were occasional, 12 species (23.52%) were frequent, 7 species (13.72%) were rare, 5 species (9.803%) were common and only 1 species *Cynodon dactylon* (1.960%) was abundant in the whole area and present everywhere in the research area in every season.

**Conclusion:** It has been concluded from the study that unwise collection, over-grazing, over-exploitation, over-consumption and overutilization are major biotic factors, which affect the diversity of the grasses in the area and affect the populations' sustainability on the earth crust. Therefore, the study aims to document and explore wild grasses from the area, which might help in future researches. This survey will be helpful in identifying plant wealth and status for their exploitation on systematic approaches and scientific basis.

## Keywords

Grasses, Systematic, Biological Spectra, Tribes, Abundant Class, Charsadda.

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## INTRODUCTION

Systematics in plant biodiversity is very important to know about the study of species diversity and its conservation, extinction and evolution, threats to biodiversity and biogeographic regions, exploration and other ecological services<sup>1</sup>. Diversity basically means total number of

species within specific geographic areas, whether alien or native, which is the identity and source of vegetation and plant natural resources. Agriculture, deforestation, over-grazing, over-browsing, natural disasters and anthropogenic interaction are mainly affected by the plant

resources<sup>2</sup>. The family Poaceae (Grass family) is the 4<sup>th</sup> spermatophyte family having 11000 species and 800 genera worldwide. However, in Pakistan, a total of 158 genera and 492 species are available<sup>3</sup>. Arundinoideae, Oryzoideae, Bambusoideae, Eragrostoideae and Panicoideae are important subfamilies of Gramineae<sup>4</sup>. Grasses can survive well to exposed, peripheral and commonly disturbed habitats, and it exist everywhere. Grass is characterized by the presence of its grain or caryopsis, and inflorescence having spikelet with a palea and lemma<sup>5</sup>. Overgrazing, over-browsing, water-logging, soil erosion, over-hunting and non-manageable agrarian methods have turned out to be significant dangers to biodiversity. The over-grazing of these fields has brought about harm to suitable grass and pea species. Due to continuous and heavy grazing, the pastures and forest-areas have deteriorated. The interaction of natural grassland population and its structure with regards to its well-known ecological aspects have not been identified yet<sup>6</sup>. Living organisms on the planet mostly depend on grains like maize, rice, oats, sugarcane, wheat and rye for their substantial need as energy crops. In addition, domesticated ruminants depend on these grasses. Moreover, those weeds growing on the agronomic land are also belong to the family Poaceae. This floristic survey provides a baseline to taxonomists to work on different aspects of plant wealth and status for their exploitation on systematic approaches and scientific basis.

A large number of livestock depends on natural vegetation through over-grazing and over-browsing, for fodder. Moreover, fuel, tubers and other edible parts are received from the forest in addition to the cultivation of some seasonal agricultural crops like maize and wheat in small areas<sup>7</sup>. Grasses are among the most adaptable life forms<sup>8</sup>. The flower of grasses suggests that they are tri-staminate, bi-stigmatic and lodiculated in which stamens exist in two different cycles-two lateral from inner whorl and single outer frontal whorl<sup>9</sup>. The information with regards to species configuration of a region is considered to be an incentive for any phyto-geographical, environmental, ecological, and managing events. The floristic structure reveals the variety of natural resources which are affected by different abiotic and biotic stresses viz. over-grazing, over-browsing, deforestation, soil

texture, soil corrosion and improper collection of these grasses in the area<sup>10</sup>. Different authors have studied grasses time to time. In Pakistan most of the study on grasses was done by Chaudhari *et al.*,<sup>11</sup> who studied ethnobotany of grasses from Thal desert, Pakistan, while Mehmood *et al.*,<sup>7</sup> documented floristic list of grasses from Tor Ghar, Pakistan in which 73 species with 54 genera and 6 subfamilies were included. Samreen *et al.*,<sup>12</sup> also conducted the similar study on grasses from district Bannu, Pakistan.

### Objectives of the Research

The main focus of our study was the documentation and exploration of wild grasses from the area, which might help in future researches.

A floristic survey was conducted helpful in identifying plant wealth and status for their exploitation on systematic approaches and scientific basis.

## MATERIALS AND METHODS

### Site Details and Duration of the Study

The current survey was carried out in the District Charsadda in the blooming and flowering season during 2017-18 to assemble diverse grass species from the selected area. District Charsadda lies between 34° 03' to 34° 28' North latitude and 71° 28' to 71° 33' East longitude. Charsadda being the geographic center lies about 282m above sea level, covers an area of 996 square.km<sup>2</sup>. The annual precipitation rate is 460.0mm, whereas the hottest month is June (44°C), the coldest month is January (5°C-10°C) and the wettest month is February. Charsadda is surrounded by four districts and one tribal area, on the East is district Mardan, on the North is Malakand, on the South is Peshawar and Nowshera districts and Mohmand Agency on the West<sup>13</sup>.

### Dominant Flora of the Area

District Charsadda has a unique type of flora which includes a lot of green land vegetation. This District has different types of vegetation comprising herbs, trees, lianas, shrubs and climbers. Among the trees, diverse floral plant species exist, which belong to different genera and families. In selected areas, *Morus alba*, *Dilbergia sissoo*, *Acacia modesta*, *Morus nigra*, *Morus laevigata*, *Populus ciliate*, *Acacia nilotica*, *Melia azedarach*,

*Eucalyptus lanceolata*, *Bombax ceiba*, *Ficus carica*, *Citrus medica*, *Ficus elastica*, *Prunus domestica*, *Ailanthus altissima* and *Ziziphus jujuba* are used as fuel, food, medicine and for making furniture etc.

### Field Methodology:

#### Collection, Preservation and Identification of Sample Grasses

Grass specimens were collected, dried in the shade for two weeks, preserved, mounted and then identified with the assistance of Pakistans' flora (Nasir & Ali<sup>14</sup>; Stewart<sup>15</sup>; Ali & Nasir<sup>16</sup>; Ali & Qaiser<sup>17</sup>) and other literature (Raunkiaer<sup>18</sup>; Hussain<sup>19</sup>). Habitat class and life cycle of each specimen were examined. Abundant classes were determined through ACFOR scale to describe species abundance in a given area. Quantitative ecological techniques were applied to determine various ecological attributes. In biological spectrum, each ecological parameter was categorized as followed by Raunkiaer<sup>18</sup>; Hussain<sup>19</sup>.

## RESULTS AND DISCUSSION

Poaceae is an important grass family with great economic importance as it contains crops like *Oryza sativa*, *Triticum aestivum*, *Zea maize*, *Hordeum vulgare*, *Avena sativa* and *Pennisetum typhoides*. It is one of the leading families of Angiospermic plants growing in every part of the earth's crust. The current work presents a total of 51 taxa with 34 genera, 5 subfamilies and 11 tribes were collected from the District Charsadda (Table 1, 3 & 4). Among them, 3 species belonged to the genus *Eragrostis* (8.823%), *Saccharum* (8.823%) and *Setaria* (8.823%) respectively. Genera *Avena*, *Brachiaria*, *Bromus*, *Cymbopogon*, *Digitaria*, *Echinochloa*, *Hordeum*, *Phragmites*, *Poa*, *Polypogon* and *Sorghum* had 2 species (5.882%) each. While the remaining genera *Alepecurous*, *Apluda*, *Arundo*, *Acrachne*, *Cenchrus*, *Cynodon*, *Dactyloctenium*, *Desmostachya*, *Dichantium*, *Eleusine*, *Imperata*, *Leptochloa*, *Oryza*, *Paspalum*, *Pennesetum*, *Phalaris*, *Rostraria*, *Stipa*, *Triticum* and *Zea* had 1 species (2.941%) each. The dominant genera were *Eragrostis*, *Saccharum* and *Setaria* 3 taxa followed by *Avena*, *Brachiaria* and *Bromus* 2 taxa followed by *Alepecurous*, *Apluda* and *Arundo* had only one taxa. The subfamily *Arundinoideae* had only 1 tribe and 3 taxa, *Chloridoideae* had 2 tribes

*Cynodonteae* and *Eragrosteae*, the tribe *Cynodonteae* had 1 taxa, while the tribe *Eragrosteae* had 7 taxa, the subfamily *Oryzoideae* had 1 tribe and 1 taxa, the subfamily *Panicoideae* had 2 tribes *Andropogoneae* and *Paniceae*, the tribe *Andropogoneae* had 11 taxa, while the tribe *Paniceae* had 12 taxa, the subfamily *Pooideae* had 5 tribes viz. *Aveneae*, *Bromeae*, *Poeae*, *Stipeae* and *Triticeae*. The tribe was first documented by Barthélemy Charles Joseph Dumortier from Belgian in 1823 who named it *Triticeae*<sup>20</sup>. The Tribe *Poeae* had 5 taxa, the tribe *Aveneae* had 4 taxa, the tribe *Triticeae* had 3 taxa, the tribe *Bromeae* had 2 taxa and the tribe *Stipeae* had only 1 taxa. The dominant subfamily was *Pooideae* having 5 tribes followed by *Chloridoideae* and *Panicoideae* having 2 tribes each, followed by *Arundinoideae* and *Oryzoideae* having only 1 tribe each. Various scientists also conducted the same study from different regions of Pakistan (Ahmad *et al.*,<sup>21</sup> Mehmood *et al.*,<sup>7</sup> Rafay *et al.*,<sup>22</sup> Ahmad *et al.*,<sup>23</sup> and Ullah *et al.*,<sup>24</sup>). The biological spectrum is the climatic indicator of an area and can be considered as a symbolic representation of deep and shallow or soft and harsh climate of an area. Therefore, it plays an important role in vegetation description<sup>25</sup>.

Biological spectrum (Table 1 & 2-A) showed that in the Life form class, *Therophyte* was the leading life form class with 32 species (62.74%), followed by *Hemicryptophyte* having 13 species (25.49%), further followed by *Chaemophyte* and *Geophyte* with 3 species (5.882%) each (Figure 1).

In the Leaf size class, *microphyll* had the largest number of species i.e., 24 (47.05%) followed by *nanophyll* having 14 species (27.45%), *mesophyll* with 8 species (15.68%), followed by *macrophyll* 3 species (5.882%) and *leptophyll* 2 species (3.921%), respectively (Table 1 & 2-B, Figure 2). The Therophytic life form can survive with adverse environmental conditions and penetrating anthropogenic disturbance, whereas another affecting factor includes high grazing pressure. Climatic and anthropogenic disturbance in a specific area represents variation in both the Leaf size class and Life form class<sup>25</sup>. *Therophytes* and *microphylls* dominancy indicates the harshness, warmth and climatic environment of the area and the duration of the winter period. Only the cone-bearing and sclerophyllous plants sustain their life span is an

evergreen area and remain vigorous during the winter season<sup>26</sup>. Our findings are in line with that of Ali *et al.*,<sup>27</sup>; Khan and Shah<sup>28</sup> and Sher *et al.*,<sup>29</sup>, who also proved the dominance of the therophytic and microphyllus class in his study. Badshah *et al.*,<sup>2</sup> stated that species composition is an ecological expression that not only reveals the proper description of semiarid regions, but also gives a lot of quantitative exploration of the vegetation resources that must be needed. Thus, species composition is a basic parameter of plant phenology and conservation of plants in any specific area. The ecological studies of plants bio-spectrum, habit, habitat, flowering season, phenology and its ethnoecological amplitude are to be worked out. The richness of the number of species of *Asteraceae* and *Poaceae* is due to their extensive conservation in a geographical area. The Habitat class (Table 1 & 2-C, Figure 3) showed that 32 species (62.74%) were terrestrial and 19 species (37.25%) were amphibious in our study. The Life cycle class (Table 1 & 2-D, Figure 4) depicted that 33 species (64.70%) were annual, 17 species (33.33%) were perennial and 1 specie (1.960%) was annual or perennial. The Abundant class was determined by the ACFOR scale used to describe species abundance in a given area; 26 species (50.98%) were occasional, 12 species (23.52%) were frequent, 7 species (13.72%) were rare, 5 species (9.803%) were common and only 1 species *Cynodon dactylon* (1.960%) was abundant in whole area and present everywhere in research area in every season (Table 1 & 2-E, Figure 5). The Palatability class (Table 2-F & 5, Figure 6) showed that 35 species (68.62%) were highly palatable followed by less-palatable 11 species (21.56%), non-palatable 2 species (3.921%) and moderately palatable 3 species (5.882%) (Table 5). Khan and Shah<sup>28</sup> also gave the statement of palatability from the district Mardan. Thus, the taxonomic study of *Poaceae* suggested that it is very homogenous taxon and field recognized family, the stem is usually rounded, hollow internodes are present, 2-ranked leaves, open or sometimes closed sheath, ligule present, floret (flower) containing two bracts palea and lemma, 0-3 lodicules in perianth, the stamens usually 3 in number and the fruit is grain or caryopsis<sup>30</sup>. Zereen *et al.*,<sup>31</sup> studied the uses of grasses from central Punjab. A total of 51 species and 46 genera of grasses were reported from the area. Our findings also agree with that

of Perveen and Kaiser<sup>30</sup>, Osman *et al.*,<sup>32</sup> Yen and Yang<sup>20</sup>, who also reported grass species from various parts of the country. As it is clear that no prior work has been done on the grasses in the Charsadda district, hence the current study is a benchmark for future researches.

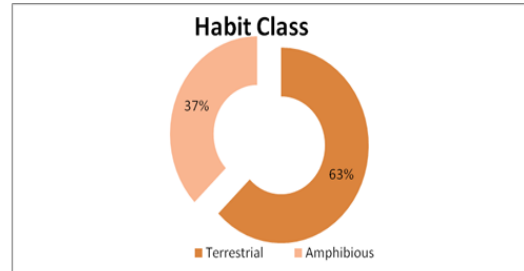


Figure 1. Percentage of Habitat Class of the Flora.

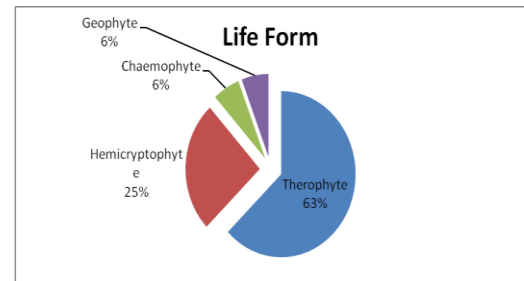


Figure 2. Percentage of Life Form Class.

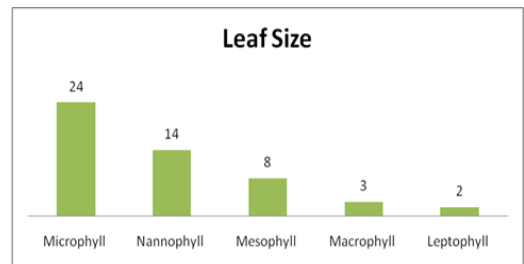


Figure 3. Graph Showing the Proportions of Leaf Size Spectrum.

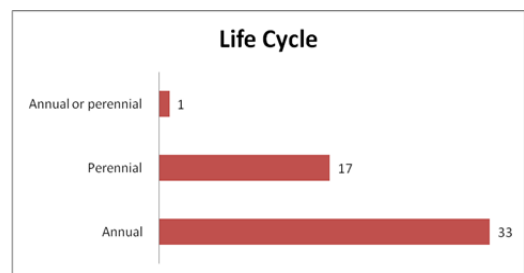


Figure 4. Bar-Graph Showing the Proportions of Life Span.

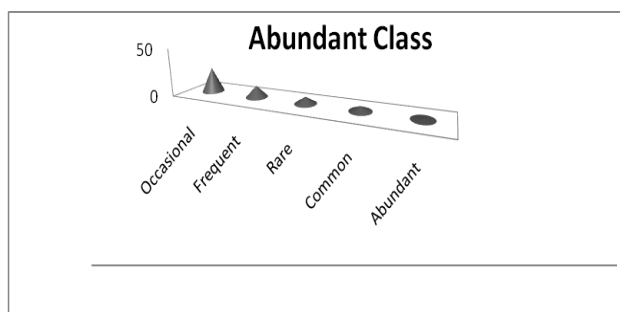


Figure 5. Showing the Proportions Abundant Class.

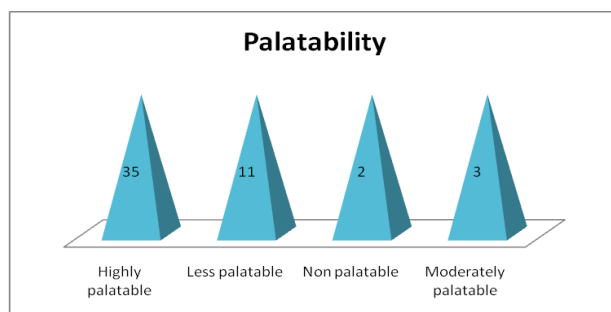


Figure 6. Graph Showing Palatability Status of Plants.

Table 1. Biological Spectrum of Some Palatable Grasses of District Charsadda.

S. No.	Botanical Name	English Name	Habitat	Life Cycle	Abundance Class	Life Form	Leaf Size
1.	<i>Alopecurus myosuroides</i> Hudson.	Slender Foxtail	Amphibious	Annual	Frequent	Th	Mes
2.	<i>Apluda mutica</i> L.	Mauritian grass	Terrestrial	Perennial	Frequent	Th	Mic
3.	<i>Arundo donax</i> L.	Giant reed	Amphibious	Perennial	Frequent	Geo	Mes
4.	<i>Acrachne racemosa</i> Heyne ex Roem. Schult	Goose grass.	Terrestrial	Annual	Rare	H	Mic
5.	<i>Avena fatua</i> L.	Oat	Amphibious	Annual	Frequent	Th	Mic
6.	<i>Avena sativa</i> L.	Wild oat	Amphibious	Annual	Occasional	Th	Na
7.	<i>Brachiaria ramosa</i> (Linn.) Stapf	Browntop Millet	Terrestrial	Annual	Occasional	Th	Mic
8.	<i>Brachiaria reptans</i> (Linn.) Gardner & Hubbard.	Running Grass	Amphibious	Annual	Frequent	Th	Mic
9.	<i>Bromus catharticus</i> Vahl.	Rescue grass	Terrestrial	Perennial	Occasional	Th	Mic
10.	<i>Bromus pectinatus</i> Thunb.	Brome grass	Terrestrial	Annual	Occasional	Th	Mes
11.	<i>Cenchrus ciliaris</i> L.	Buffel grass, kolukkatai	Terrestrial	Perennial	Occasional	Th	Mes
12.	<i>Cymbopogon citratus</i> (DC.) Stapf.	Lemon grass or oil grass	Terrestrial	Perennial	Rare	H	Mes
13.	<i>Cymbopogon jwarancusa</i> (Jones) Schult	Oil grass	Terrestrial	Perennial	Frequent	H	Na
14.	<i>Cynodon dactylon</i> (L.) Pers	Bermuda grass	Terrestrial	Perennial	Abundant	H	Lep
15.	<i>Dactyloctenium aegyptium</i> (L.) Willd	crow foot grass	Amphibious	Annual	Occasional	Th	Mic
16.	<i>Desmostachya bipinnata</i> (L.) Stapf.	Salt reed-grass	Amphibious	Perennial	Common	H	Na
17.	<i>Dichanthium annulatum</i> (Forssk.) Stapf	Hindi grass, Sheda grass	Amphibious	Perennial	Common	H	Na
18.	<i>Digitaria ciliaris</i> (Retz.) Koeler.	Crab grass	Amphibious	Annual	Occasional	H	Mic
19.	<i>Digitaria sanguinolenta</i> Edgew. ex Aitch.	Hairy crabgrass,	Amphibious	Annual	Rare	H	Mic
20.	<i>Echinochloa colona</i> (L.) Link	Jungle rice	Amphibious	Annual	Occasional	Th	Na
21.	<i>Echinochloa crus-gallis</i> (L.) Beauv		Terrestrial	Annual	Occasional	Th	Na
22.	<i>Eleusine indica</i> (L.) Gaertn.	Indian goose grass	Amphibious	Annual	Occasional	Th	Mes

23	<i>Eragrostis nigra</i> Nees. Ex. S	Love grass	Amphibious	Annual or perennial	Occasional	Th	Mic
24.	<i>Eragrostis cilianensis</i> (All.) Lut.	Love grass	Terrestrial	Annual	Rare	H	Na
25.	<i>Eragrostis minor</i> Host.	Pungent meadow grass	Amphibious	Annual	Occasional	Th	Na
26.	<i>Hordeum murinum</i> L.	False barley	Terrestrial	Annual	Occasional	Th	Na
27.	<i>Hordeum vulgare</i> L.	Barley, barley corn	Terrestrial	Annual	Frequent	Th	Mic
28.	<i>Imperata cylindrica</i> (L.) P. Beauv.	Cogon grass	Amphibious	Perennial	Occasional	Geo	Lep
29.	<i>Leptochloa panicea</i> Retz.	Mucronate Sprangletop	Terrestrial	Annual	Occasional	Th	Mic
30.	<i>Oryza sativa</i> L.	Asian Rice, weedy rice	Amphibious	Annual	Frequent	Th	Mic
31.	<i>Paspalum paspalodes</i> (Michx.) scribner.	Water couch, Knotgrass	Terrestrial	Perennial	Frequent	H	Mic
32.	<i>Pennisetum typhoides</i> (Burm.f.) Stapf.	Pearl millet	Terrestrial	Annual	Occasional	Th	Mic
33.	<i>Phalaris minor</i> Retz.	Canary grass	Terrestrial	Annual	Frequent	Th	Na
34.	<i>Phragmites australis</i> (Cav.) Trin.	Common reed	Amphibious	Perennial	Occasional	Geo	Mac
35.	<i>Phragmites karka</i> (Retz.) Trin. ex. Steud.	Nodding reed	Amphibious	Perennial	Occasional	Ch	Mes
36.	<i>Poa annua</i> L.	Annual blue grass	Terrestrial	Annual	Occasional	Th	Na
37.	<i>Poa infirma</i> H. B. K.	Early meadow-grass	Terrestrial	Annual	Occasional	Th	Na
38.	<i>Polypogon fugax</i> Ness.ex.Steud.	Asia Minor Blue grass	Terrestrial	Annual	Frequent	H	Mic
39.	<i>Polypogon monspeliensis</i> (L.) Desf	Rabbit foot grass	Terrestrial	Annual	Frequent	Th	Mic
40.	<i>Rostraria cristata</i> (L.) Tzvelev	Mediterranean hair grass	Terrestrial	Annual	Occasional	Th	Mic
41.	<i>Saccharum griffithii</i> Munro ex Boiss	Broom sedge	Terrestrial	Perennial	Rare	H	Mac
42.	<i>Saccharum officinarum</i> L.	Sugar cane	Terrestrial	Perennial	Common	Ch	Mic
43.	<i>Saccharum spontaneum</i> L.	Wild sugarcane	Terrestrial	Perennial	Occasional	Ch	Mac
44.	<i>Setaria pumila</i> (Poir.) Roem. &Schult.	Yellow foxtail grass	Terrestrial	Annual	Occasional	Th	Mic
45.	<i>Setaria verticillata</i> (L.) P. Beauv	Fox tail	Terrestrial	Annual	Rare	Th	Na
46.	<i>Setaria viridis</i> (L.) P. Beauv	Green bristle grass	Amphibious	Annual	Occasional	Th	Na
47.	<i>Sorghum bicolor</i> (L.) Moench.	Grain sorghum	Terrestrial	Annual	Occasional	Th	Mic
48.	<i>Sorghum halepense</i> (L.) Pers.	Johnson grass	Terrestrial	Perennial	Occasional	H	Mic
49.	<i>Stipa capensis</i> Thunb.	Cape rice grass	Terrestrial	Annual	Rare	Th	Mic
50.	<i>Triticum aestivum</i> L.	Common wheat	Terrestrial	Annual	Common	Th	Mic
51.	<i>Zea mays</i> L.	Corn	Terrestrial	Annual	Common	Th	Mes

**Keys:**

**A. Life form:** Th-Therophyte, H-Hemicryptophyte, Ch-Chaemeophyte, G-Geophyte.

**B. Leaf size:** Lep-Leptophyll, Na-Nanophyll, Mic-Microphyll, Mac-Macrophyll, Mes-Mesophyll

**Table 2. Ecological Physiognomies of Palatable Grasses of District Charsadda, Pakistan.**

S. No.	Parameters	No. of Taxa	Percentages
<b>A. Life form</b>			
1.	Therophyte	32	62.74
2.	Hemicryptophyte	13	25.49
3.	Chaemophyte	3	5.882
4.	Geophyte	3	5.882
<b>Total</b>		<b>51</b>	<b>99.99</b>
<b>B. Leaf size</b>			
1.	Microphyll	24	47.05
2.	Nanophyll	14	27.45
3.	Mesophyll	8	15.68
4.	Macrophyll	3	5.882
5.	Leptophyll	2	3.921
<b>Total</b>		<b>51</b>	<b>99.99</b>
<b>C. Habitat class/Adaptation</b>			
1.	Terrestrial	32	62.74
2.	Amphibious	19	37.25
<b>Total</b>		<b>51</b>	<b>99.99</b>
<b>D. Life cycle</b>			
1.	Annual	33	64.70
2.	Perennial	17	33.33
3.	Annual or perennial	1	1.960
<b>Total</b>		<b>51</b>	<b>99.99</b>
<b>E. Abundant class</b>			
1.	Occasional	26	50.98
2.	Frequent	12	23.52
3.	Rare	7	13.72
4.	Common	5	9.803
5.	Abundant	1	1.960
<b>Total</b>		<b>51</b>	<b>99.99</b>
<b>F. Palatability</b>			
1.	Highly palatable	35	68.62
2.	Less palatable	11	21.56
3.	Non palatable	2	3.921
4.	Moderately palatable	3	5.882
<b>Total</b>		<b>51</b>	<b>99.99</b>

**Table 3. List of Genera and its Percentage.**

S. No.	Genera	No. of Taxa	Percentages
1.	<i>Eragrostis</i>	3	8.823%
2.	<i>Saccharum</i>	3	8.823%
3.	<i>Setaria</i>	3	8.823%
4.	<i>Avena</i>	2	5.882%
5.	<i>Brachiaria</i>	2	5.882%
6.	<i>Bromus</i>	2	5.882%
7.	<i>Cymbopogon</i>	2	5.882%
8.	<i>Digitaria</i>	2	5.882%
9.	<i>Echinochloa</i>	2	5.882%
10.	<i>Hordeum</i>	2	5.882%
11.	<i>Phragmites</i>	2	5.882%
12.	<i>Poa</i>	2	5.882%
13.	<i>Polypogon</i>	2	5.882%
14.	<i>Sorghum</i>	2	5.882%
15.	<i>Apluda</i>	1	2.941%
16.	<i>Alopecurus</i>	1	2.941%
17.	<i>Arundo</i>	1	2.941%
18.	<i>Acrachne</i>	1	2.941%
19.	<i>Cenchrus</i>	1	2.941%
20.	<i>Cynodon</i>	1	2.941%
21.	<i>Desmostachya</i>	1	2.941%
22.	<i>Dactyloctenium</i>	1	2.941%
23.	<i>Dichanthium</i>	1	2.941%
24.	<i>Eleusine</i>	1	2.941%
25.	<i>Imperata</i>	1	2.941%
26.	<i>Leptochloa</i>	1	2.941%
27.	<i>Oryza</i>	1	2.941%
28.	<i>Paspalum</i>	1	2.941%
29.	<i>Pennesetum</i>	1	2.941%
30.	<i>Phalaris</i>	1	2.941%
31.	<i>Rostraria</i>	1	2.941%
32.	<i>Stipa</i>	1	2.941%
33.	<i>Triticum</i>	1	2.941%
34.	<i>Zea</i>	1	2.941%
<b>Total</b>	<b>34</b>	<b>51</b>	<b>99.99%</b>



Table 4. Distribution of Sub Families, Tribes and Taxa.

S. No.	Sub Family	Tribe	Taxa
1.	Arundinoideae	Arundineae	<i>Arundo donax</i> L.
			<i>Phragmites australis</i> (Cav.) Trin. ex Steud
			<i>Phragmites karka</i> (Retz.) Trin. ex. Steud
2.	Chloridoideae	Cynodonteae	<i>Cynodon dactylon</i> (L.) Pers.
		Eragrosteae	<i>Acrachne racemosa</i> (B. Heyne ex Roth) Ohwi.
			<i>Dactyloctenium aegyptium</i> (L.) Willd
			<i>Desmostachya bipinnata</i> (L.) Stapf.
			<i>Eleusine indica</i> (L.) Gaertn.
			<i>Eragrostis nigra</i> Nees. Ex. Steud
			<i>Eragrostis cilianensis</i> (All.) Lut.
			<i>Eragrostis minor</i> Host.
			<i>Leptochloa panicea</i> Retz.
		3.	Oryzoideae
4.	Panicoideae	Andropogoneae	<i>Apluda mutica</i> L.
			<i>Cymbopogon citratus</i> (DC.) Stapf.
			<i>Cymbopogon jwarancusa</i> (Jones) Schult.
			<i>Dichanthium annulatum</i> (Forssk.) Stapf.
			<i>Imperata cylindrica</i> (L.) P. Beauv
			<i>Saccharum griffithi</i> Munro ex Boiss.
			<i>Saccharum officinarum</i> L.
			<i>Saccharum spontaneum</i> L.
			<i>Sorghum bicolor</i> (L.) Moench
			<i>Sorghum halepense</i> (L.) Pers
		<i>Zea mays</i> L.	
		Paniceae	<i>Brachiaria ramosa</i> L.
			<i>Brachiaria reptans</i> (L.) Gardner & Hubbard
			<i>Cenchrus ciliaris</i> L.
			<i>Digitaria ciliaris</i> (Retz.) Koeler.
			<i>Digitaria sanguinolenta</i> Edgew. ex Aitch.
			<i>Echinochloa colona</i> (L.) Link
<i>Echinochloa crus-gallis</i> (L.) Beauv			
<i>Paspalum paspalodes</i> (Michx.) Scribn.			
<i>Pennesetum typhoides</i> (Burm.f.) Stapf & C.E. Hubb.			
<i>Setaria pumila</i> (Poir.) Roem. & Schult.			
<i>Setaria verticillata</i> (L.) P. Beauv			
<i>Setaria viridis</i> (L.) P. Beauv			
5.	Pooideae	Aveneae	<i>Avena fatua</i> L.
			<i>Avena sativa</i> L.
			<i>Polypogon fugax</i> Ness. ex Steud
		Bromeae	<i>Polypogon monspeliensis</i> (L.) Desf
			<i>Bromus catharticus</i> Vahl.
		Poeae	<i>Bromus pectinatus</i> Thunb.
			<i>Alopecurus myosuroides</i> Hudson.
			<i>Phalaris minor</i> Retz.
			<i>Poa annua</i> L.
			<i>Poa infirma</i> H. B. K.
		Stipeae	<i>Rostraria cristata</i> (L.) Tzvelev
			<i>Stipa capensis</i> Thunb.
		Triticeae	<i>Hordeum murinum</i> L.
			<i>Hordeum vulgare</i> L.

Source: Gould & Shaw<sup>33</sup>, (1983)

**Table 5. Botanical Taxa and its Common Names, Palatability and Distribution Pattern of Weedy Grasses in Pakistan and in the World.**

S. No.	Taxon	Common Name	Palatability	Distribution Pattern in Pakistan	Distribution Pattern in World
1.	<i>Alopecurus myosuroides</i> Hudson	Slender Foxtail	Highly palatable	Baluchistan, Khyber PakhtunKhwa & Kashmir	Europe, Asia, North America and other temperate regions of the world
2.	<i>Apluda mutica</i> L.	Mauritian grass	Highly palatable	Sind, Punjab, Khyber PakhtunKhwa & Kashmir	Tropical Asia, new Caledonia, Oman, new Guinea and throughout Australia
3.	<i>Arundo donax</i> L.	Giant reed	Less palatable	Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Eastwards to Burma; Mediterranean regions and North Africa and introduced into new World
4.	<i>Acrachne racemosa</i> Heyne ex Roem. & Schult	Goose grass	Highly palatable	Punjab, Khyber PakhtunKhwa & Kashmir	Tropical part of Australia, southeast Asia and Africa
5.	<i>Avena fatua</i> L.	Oat	Highly palatable	Khyber PakhtunKhwa and Northern Punjab	Central Asia, Europe, USA, Mississippi, Tennessee and Australia
6.	<i>Avena sativa</i> L.	Wild oat	Highly palatable	Khyber PakhtunKhwa and Punjab	Throughout Europe, Asia and northwest Africa
7.	<i>Brachiaria ramosa</i> (Linn.) Stapf	Browntop Millet	Highly palatable	Kashmir, Punjab, Baluchistan, Sind, Khyber PakhtunKhwa	Tropical Asia, South Africa, Senegal, Yemen, Rhodesia and Malawi
8.	<i>Brachiaria reptans</i> (Linn.) Gardner & Hubbard.	Running Grass	Highly palatable	Khyber PakhtunKhwa, Sind, Baluchistan & Punjab	Tropical Asia and throughout the tropics
9.	<i>Bromus catharticus</i> Vahl.	Rescue grass	Highly palatable	Punjab & Khyber PakhtunKhwa	Native to South America, Europe, Australia and North America.
10.	<i>Bromus pectinatus</i> Thunb.	Brome grass	Highly palatable	Khyber PakhtunKhwa, Baluchistan, Punjab, Gilgit & Kashmir	Through Ethiopia, Egypt and Sudan, Arabia and Sinai, South Africa, Afghanistan, Iran, eastwards through India to Europe and China.
11.	<i>Cenchrus ciliaris</i> L.	Buffel grass, kolukkatai	Less palatable	Khyber PakhtunKhwa, Baluchistan, Sind & Punjab	Distributed throughout Africa, extending through Middle East to Arabia and to India
12.	<i>Cymbopogon citratus</i> (DC.) Stapf.	Lemon grass or oil grass	Non-palatable	Khyber PakhtunKhwa and Punjab	North and Central America, Sri Lanka, China, India, Pakistan, Indonesia, Nigeria, Thailand, Cameroon, Italy, Congo, Egypt, Argentina, Brazil, Venezuela and Papua Guinea.
13.	<i>Cymbopogon jwarancusa</i> (Jones) Schult.	Oil grass	Less palatable	Khyber PakhtunKhwa, Sind, Baluchistan, Punjab & Gilgit	Westwards to Iraq and Socotra also in Nepal and Northwest India
14.	<i>Cynodon dactylon</i> (L.) Pers	Bermuda grass	Highly palatable	Sind, Khyber PakhtunKhwa, Baluchistan, Punjab & Kashmir	Warm temperate and Tropical regions; Cosmopolitan
15.	<i>Dactyloctenium aegyptium</i> (L.) Willd	Crow foot Grass	Highly palatable	Khyber PakhtunKhwa, Sind, Punjab & Kashmir	Commonly spread in warm temperate and tropical regions of the world.
16.	<i>Desmostachya bipinnata</i> (L.) Stapf	Salt reed-grass	Less palatable	Sind, Baluchistan, Punjab Kashmir & Khyber PakhtunKhwa	Through-out the Middle east to Indo-China, tropical Africa and North America

17.	<i>Dichanthium annulatum</i> (Forssk.) Stapf.	Hindi grass, Sheda grass	Highly palatable	Sind, Baluchistan, Punjab Kashmir & Khyber PakhtunKhwa	Tropical America, Middle East, Kenya, Tanzania, southern Africa and Senegal, Indonesia and introduced to Australia.
18.	<i>Digitaria ciliaris</i> (Retz.) Koeler.	Summer grass	Highly palatable	Sind, Punjab, Kashmir & Khyber PakhtunKhwa.	Throughout the Tropics.
19.	<i>Digitaria sanguinolenta</i> Edgew. Ex Aitch	Hairy crabgrass, Hairy finger grass.	Highly palatable	Baluchistan, Khyber PakhtunKhwa, Punjab, Gilgit & Kashmir	Tropical and temperate, specifically into the tropics.
20.	<i>Echinochloa colona</i> (L.) Link.	Jungle rice	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Distributed throughout tropics and sub tropics
21.	<i>Echinochloa crus-galli</i> (L.) Beauv.	Cockspur grass, water grass	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa, Gilgit & Kashmir	Confined to the Subtropical and temperate regions of the world
22.	<i>Eleusine indica</i> (L.) Garetn.	Indian goose grass	Highly palatable	Sind, Khyber PakhtunKhwa & Kashmir	Present in Subtropical and Tropical zones of the world
23.	<i>Eragrostis nigra</i> Nees. Ex. Steud	Love grass	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa	Present in Subtropical and Tropical zones of the world
24.	<i>Eragrostis cilianensis</i> (All.) Lut. Ex.F.T.	Love grass	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Present in moist and Tropical zones of the world
25.	<i>Eragrostis minor</i> Host.	Pungent meadow grass	Highly palatable	Sind, Punjab, Gilgit, Baluchistan, Khyber PakhtunKhwa & Kashmir	Subtropical and Warm temperate regions of the world
26.	<i>Hordeum murinum</i> L.	False barley	Less palatable	Khyber PakhtunKhwa & Kashmir	Central Asia and Mediterranean regions to China.
27.	<i>Hordeum vulgare</i> L.	Barley, barley corn	Less palatable	Sind, Punjab, Khyber PakhtunKhwa & Kashmir	Throughout most temperate zones of the world
28.	<i>Imperata cylindrica</i> (L.) P. Beauv.	Cogon grass	Moderately palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa, Gilgit & Kashmir	Mediterranean, Old World tropics, Middle East and also in Chile.
29.	<i>Leptochloa panicea</i> Retz.	Mucronate Sprangletop	Moderately palatable	Sind, Punjab & Khyber PakhtunKhwa	Natal; Sudan to Transvaal; Tropical Asia and West Africa
30.	<i>Oryza sativa</i> L.	Asian Rice, weedy rice	Less palatable	Sind, Punjab, Khyber PakhtunKhwa and the chief crop is in Kashmir (Liddar Valley).	Cultivated mostly in Central and South America, southern Europe, Africa, Asia and Australia
31.	<i>Paspalum paspalodes</i> (Michx.) scribner	Water couch, Knotgrass	Moderately palatable	Sind, Punjab, Khyber PakhtunKhwa & Kashmir	Tropics and sub-tropics throughout the world.
32.	<i>Pennisetum typhoides</i> (Burm.f.) Stapf & C.E. Hubb.	Pearl millet	Highly palatable	Punjab, Sindh, Khyber PakhtunKhwa and Balochistan	South Africa from West to East; It was Alien to India and later to Australia, America and Brazil.
33.	<i>Phalaris minor</i> Retz.	Canary grass	Highly palatable	Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Cosmopolitan
34.	<i>Phragmites australis</i> (Cav.) Trin. exSteud.	Common reed	Non palatable	Khyber PakhtunKhwa, Punjab & Kashmir.	Distributed throughout moderate climate zones of New World and Old World
35.	<i>Phragmites karka</i> (Retz.) Trin. ex. Steud.	Nodding reed	Less palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa, Gilgit & Kashmir	Throughout Polynesia, Tropical Africa, tropical Asia and northern Australia.
36.	<i>Poa annua</i> L.	Annual blue grass	Highly palatable	Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Cosmopolitan
37.	<i>Poa infirma</i> H. B. K.	Early meadow-grass	Highly palatable	Punjab & Khyber PakhtunKhwa	Central Asia, Himalayas of South America; South Europe
38.	<i>Polypogon fugax</i> Ness. ex. Steud.	Asia Minor Blue grass	Highly palatable	Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Mainly in Himalayas of Burma and Iraq

39.	<i>Polypogon monspeliensis</i> (L.) Desf.	Rabbit foot grass	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa, Gilgit & Kashmir	Introduced and adopted in most warm temperate regions; Mediterranean northwards zones to British Isles; India and China; North-east parts of south Africa
40.	<i>Rostraria cristata</i> (L.) Tzelev.	Mediterranean hair grass	Highly palatable	Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Mediterranean region and Northwest India; introduced in North America and South Africa
41.	<i>Saccharum griffithii</i> Munro ex Boiss	Broom sedge	Less palatable	Sind, Baluchistan, Punjab & Khyber PakhtunKhwa	Asia-temperate; Asia-tropical; western Asia and Arabia. Afghanistan; India, Bangladesh; Iran; Pakistan; Oman; Yemen; Saudi Arabia and West Himalaya
42.	<i>Saccharum officinarum</i> L.	Sugar cane	Highly palatable	Sindh, Punjab and Khyber PakhtunKhwa	Throughout the tropical regions while extending to temperate regions of the world.
43.	<i>Saccharum spontaneum</i> L.	Wild sugarcane	Less palatable	Sind, Punjab, Khyber PakhtunKhwa, Gilgit & Kashmir	Extensively scattered in the tropical region of the Old World.
44.	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	Yellow foxtail grass	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa, Gilgit & Kashmir	Introduced into warm temperate and Tropical zones of the Old World and North America.
45.	<i>Setaria verticillata</i> (L.) P. Beauv.	Fox tail	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa & Kashmir	Confined to the warm temperate, Tropical regions of the world.
46.	<i>Setaria viridis</i> (L.) P. Beauv.	Green bristle grass	Highly palatable	Baluchistan, Punjab, Gilgit, Kashmir and Khyber PakhtunKhwa.	Introduced to New World while present also in cooler zones of the Old World
47.	<i>Sorghum bicolor</i> (L.) Moench.	Grain sorghum	Highly palatable	Sind, Baluchistan, Punjab, Khyber PakhtunKhwa	Radiating center/hotspot in Africa, and is now widely cultivated in subtropical and tropical regions of the world.
48.	<i>Sorghum halepense</i> (L.) Pers.	Johnson grass	Highly palatable	Sind, Punjab, Baluchistan, Gilgit, Kashmir and Khyber PakhtunKhwa.	Mediterranean zones of southwards to Madras and Kashmir
49.	<i>Stipa capensis</i> Thunb.	Cape rice grass	Highly palatable	Baluchistan, Punjab, Kashmir and Khyber PakhtunKhwa	Mediterranean region eastwards to Northwest India; South Africa.
50.	<i>Triticum aestivum</i> L.	Common wheat	Less palatable	Throughout Pakistan	Widely cultivated all over the world.
51.	<i>Zea mays</i> L.	Corn/ Makki	Highly palatable	Sind, Punjab, Khyber PakhtunKhwa, Kashmir, Gilgit and Balochistan	Introduced to the Old World from tropical America.

## CONCLUSION

In the present study, we have reported 51 grass species belonging to 34 genera from 5 sub-families and 11 tribes for the first time from this area. The subfamily Panicoideae were more diverse sharing highest number of taxa, genera and tribes followed by subfamily Pooideae. Biological data represents that Therophyte was the dominant life form class, while the leaf size of Microphyll was dominant. Majority of our studied grasses were terrestrial with annual life span. The palatable grasses were documented due to its grazing in the area

while fewer numbers of grasses were observed occasional in the area. *Cynodon dactylon* were recorded abundant in the study area. Therefore, it was concluded that due to uncontrolled grazing, over-exploitation and over-consumption are the major biotic threats which affects the diversity of the grasses in the area and also affects the livestock's production in the area. These present botanical endeavors provide a base line in the field of Agrostology for further study.

## LIST OF ABBREVIATIONS

ACFOR            Abundant Common Frequent  
Occasional Rare

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