*INT. J. BIOL. BIOTECH.*, 7 (3): 197-209, 2010.

# FLORISTIC AND PHYTO-SOCIOLOGICAL ASSESSMENT OF VEGETATION OF KEENJHAR LAKE AND SURROUNDING AREA (THATTA, SINDH), PAKISTAN

**Ghulam Akbar[1], Surayya Khatoon[2], M. Imran [2], Nuzhat Rizwan[3], Muhammad Zafar Khan[3] and Sadul Islam[4]**

[1] *Indus for All Programme, WWF-Pakistan. Karachi.*
[2] *Department of Botany, University of Karachi.Karachi -75270, Pakistan.*
[3] *WWF-Pakistan. Karachi*
[4]*Chotiari Wetland Complex, WWF-Pakistan. Sanghar.*

## ABSTRACT

Keenjhar Lake is one of the major fresh water reservoirs located at Thatta district of Sindh province, spread on area of about 140 km$^2$. It has been designated as Ramsar site in 1976 and a wildlife sanctuary in 1977. The Lake is a vital wetland area of great ecological, biological and economic significance. It is a major source of domestic and industrial water supplies to Karachi metropolitan. It is an important breeding and wintering area for a wide variety of birds, reptiles and mammals. Local communities especially fishermen are dependent on this important wetland for their sustenance. A detailed study was undertaken by "the Indus for All Programme of WWF-Pakistan" during 2006, 2007 and 2008 to record and document floral diversity and delineate the plant communities in and around Keenjhar Lake. A total of 7 plant communities were identified which represent a variety of habitats around the Keenjhar Lake. Significant findings during the survey included *Luffa echinata, Populus euphratica,* and *Tamarix sarenensis* which were recorded for the first time at this site. A new *Sporobolous* species was also documented which is a new addition to our knowledge. Keenjhar Lake exhibits a variety of habitats due to the presence of freshwater and its surrounding sandy, rocky and hilly areas. The small hills in the vicinity of Lake present an entirely different flora compared to that found in the low lying areas near water margins. In spite of being a freshwater Lake, patches of saline land are present at various points of its periphery that add to habitat diversity. The study presents the floristic and phytosociological details of Keenjhar lake area.

**Keywords:** Keenjhar lake, floral diversity, vegetation, wetland, Ramsar site

## INTRODUCTION

Keenjhar Lake (also called Kalri lake) is situated 113 Km from Karachi in the Thatta District of Sindh province, about 20km from Thatta city. It lies between 27º 47' N latitude and 68º 02' E longitude (Michael, 1967). It is one of the largest fresh water lakes of the country having an area of about 140 km$^2$ (Anon. 1999). It is located in a stony desert composed of alternating limestone and sandstone. Historically it was formed by the combination of two lakes Sonheri and Keenjhar. Its main source is Indus River with some proportion of water from adjacent hills and torrents. It was declared Wildlife Sanctuary in 1977 under Sindh Wildlife Protection Ordinance, 1972. The sanctuary has a buffer zone of 5 km. It has also been designated as a Ramsar site in 1976 (Anon. 1999).

The climate of this site is arid due to scanty rain fall. Temperature is comparatively mild in the close vicinity of lake as compared to other parts of Sindh, it was selected as one of the site for detailed survey in the first phase of Indus For All Programme due to its status as a Ramsar sites and an expected rich plant biodiversity due to its location at the confluence of keerthar foothills and the Indus flood plain the showing a wide diversity of habitats.

## MATERIALS AND METHODS

The survey of this site was conducted in September 2006, summer season of 2007 and spring season of 2008. Global Positioning System (GPS) was used in determining exact location of the sampling points. The species were identified with the help of various regional Floras (Jafri, 1966; Ali & Nasir, 1989-1991; Ali & Qaiser, 1992-1998, 2000-2007; Nasir & Ali 1970-1989; Matthew, 1981-83; Batanouny, 1981; Boulos, 1991; Shetty & Singh, 1987 & 1991; Bhandari, 1987; Qureshi, 2004). The collected specimens were deposited in the Karachi University Herbarium.

Field vegetation parameters like plant composition, cover, frequency and density were recorded along each transect line of 50 m using the line intercept method (Canfield 1940, Mueller-Dumbois & Ellenburg, 1974; Kent & Coker, 1992) and placing 1 m$^2$ quadrat at every 10 m interval on the same transect. Plant biomass was assessed by clipping the palatable vegetation falling in each quadrat and then taking mean biomass of 5 quadrats of each transect (Anon. 1962, Anon. 1968, Thalen and Junk 1979, Cook & Stubbendieck 1986, Saeed *et al.* 1987, Rashid *et al.*, 1988, Bonham 1989, Khan *et al.* 1989, Marwat *et al.* 1990, Wahid 1990; Dasti & Agnew 1994). In case of grasses, and palatable herbs clipping was carried out leaving 30 cm stubble height while in case of palatable shrubs and trees

only fresh growth of current year was removed (Holechek and Briske 1989; ESCAP 1994). The fresh samples of clipped vegetation were oven dried at 60 $^0$ C for 48 h to ascertain the dry matter yield (DMY) of each sample. The DMY was then calculated on hectare basis.

Cover, composition, frequency, relative cover, relative frequency, and relative density were determined (Smith, 1974; Shaukat *et al.* 1976; Chul & Moody 1983; Shukla & Srivastava 1992). The relative parameters were summed up to obtain importance value of each species. The 'Two Ways Indicator Species Analysis (TWINSPAN)' was used to delineate the plant communities on the basis of IVI, for each of the study seasons over three years.

## RESULT AND DISCUSSION

Vegetation assessment of Keenjhar Lake was carried out over three years (2006, 2007 and 2008). The cumulative number of species after these assessments comes to be 263 in 165 genera and 55 families. Among these, Pteridophytes are represented by one species in one genus and one family, Dicot Angiosperms by 185 species in 120 genera and 44 families and Monocot Angiosperms by 77 species in 44 genera and 10 families. The complete list of species is given in Table: 2. Poaceae with 51 species comes to be the largest family followed by Fabaceae with 20 species, Asteraceae and Cyperaceae with 15 species each, and Convolvulaceae with 12 species. Among genera, *Cyperus* with 9 species is the largest followed by *Tamarix, Heliotropium and Eragrostis* with 6 species each, then *Euphorbia, Indigofera and Convolvulus* with 5 species each. In addition to natural flora, nine species of cultivated plants were also recorded (Table: 1).

The Lake has a rich flora of submerged, floating and emergent aquatic plants such as *Potamogeton spp., Najas minor, Nelumbo nucifera, Nymphaea spp., Cyperus spp., Phragmites spp., Typha spp.,* etc. These provide both food and shelter to fauna species. Many birds reside in the thick growth of *Typha* and *Phragmites*. The land around the Lake has a rich diversity of semiaquatic to dry land plant species.

This site presents a rich diversity of habitats due to the presence of a large freshwater Lake and its surrounding sandy, rocky and hilly areas. The small hills in the vicinity of Lake present an entirely different flora compared to that found in the low lying areas near water margins. In spite of being a freshwater Lake, patches of saline land are present at various points of its periphery that add to habitat diversity. This is why a rich floristic diversity is recorded from this site totalling 263 species from 2006 to 2008. This number may increase after regular monitoring over next few years in different seasons. Out of 263 species, 56 can be recognized as aquatic and wetland species collected from water and surrounding moist soils. Rest of the species are dry land species collected from dry areas away from water margins. About 14 species are rare species which may become locally endangered in near future, particularly *Barleria hochstetteri, Barleria prionitis, Farsetia hamiltonii, Pycreus dwarkensis, Elionurus royleanus, Leptothrium senegalensis,* and *Anticharis linearis.* Among various families, Poaceae have shown the highest diversity which is in conformity with the typical pattern of arid lands. The islands in the Lake have their own floristic diversity. One comparatively large island near to the picnic point is somewhat rocky with calcareous hillocks bear dry land species like *Salvadore oleoides, Euphorbia caducifolia, Cadaba fruticosa, Hibiscus micranthus, Abutilon fruticosum, Barleria prionitis, Chrysopogon aucheri,* etc. In addition to these a number of annual species appear after summer rains. On periphery of the island, however, wetland species like *Oxystelma esculentum, Phragmites karka, Ipomoea carnea, Merremia hederacea, Phyllanthus maderaspatensis etc.* are present. Other islands, particularly those towards Chillia are occupied mostly by wetland species like *Typha dominghensis, Phragmites karka, Phyllanthus reticulatus, Cyperus articulatus, Merremia hederacea, Populus euphratica, Tamarix spp.* along with *Acacia nilotica. Typha and Phragmites* frequently form dense thickets which provide sheltered nesting place for a number of birds species. Annual species *Luffa echinata* is particularly prominent in the post-monsoon season. It is an extensive climber which spreads upon other larger plants. Among plants with floating leaves *Nelumbo nucifera* is the most prominent; its seeds and rhizomes are edible, the latter used as vegetable. Among submerged plants *Potamogeton pectinatus* is the most abundant. The alien invasive species *Salvinia molesta* and *Eichhornia crassipes* are quite frequent, particularly the former.

The local people depend upon the natural vegetation in various ways besides livestock grazing. *Typha and Phragmites* are used for making mats and rugs; and these along with *Saccharum and Tamarix spp.* are extensively used for thatching and hut-making. *Tamarix spp.* are also used as fuel. *Acacia nilotica and Populus euphratica* are valuable timber species. Rhizomes and petioles of *Nelumbo nucifera* are used as vegetable.

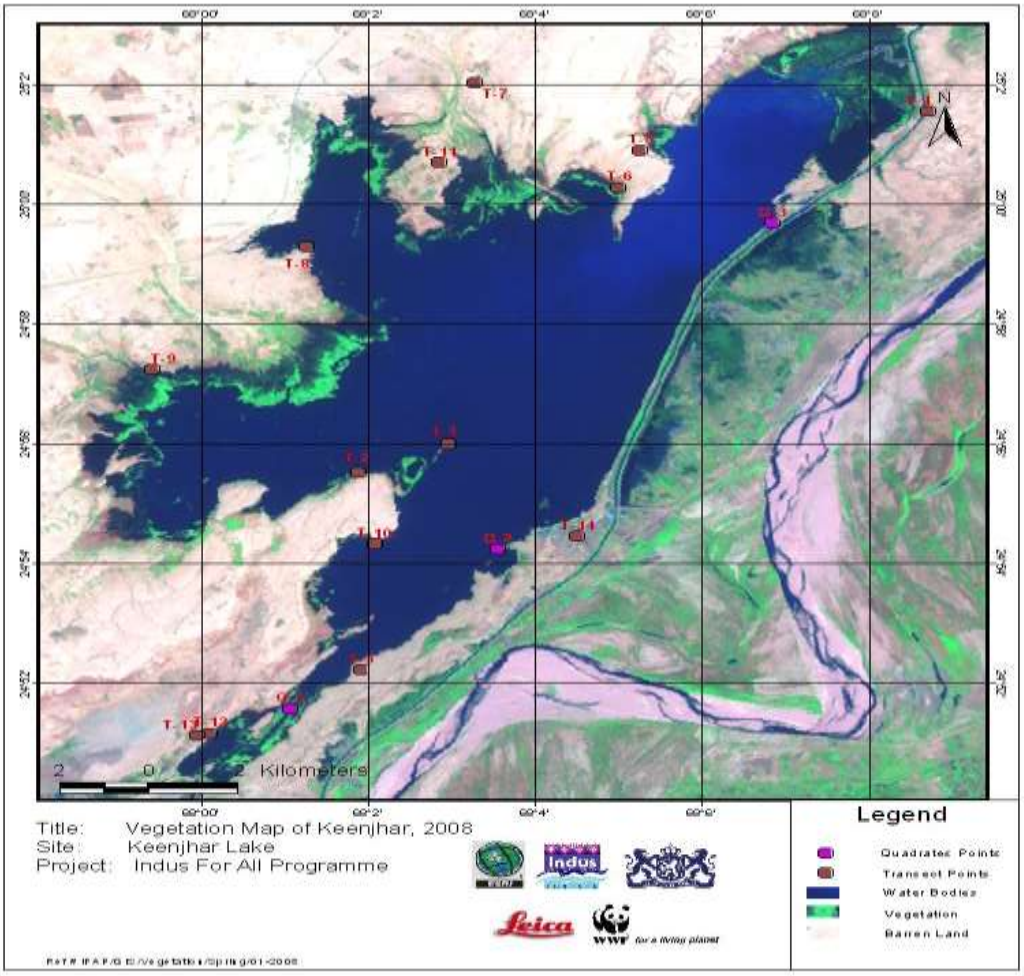
### Significant findings

***Luffa echinata:*** According to the Flora of Pakistan records, it was considered a rare species recorded only form Chitral, Swat and Tharparkar. However, this study revealed it to be abundantly present in Keenjhar (particularly in the part of Lake towards Chilliya bund).

***Populus euphratica:*** This species is also recorded for the fist time form Keenjhar Lake where it was found to be abundantly present on small islands towards Chilliya bund, Soneri and Amir Pir areas.

***Sporobolus* sp:** This is a new species that would be described later.

***Tamarix sarenensis:*** It is an endemic species of Sindh recorded from Keenjhar Lake, for the first time in the recent study, earlier it was known only from its type locality, that is lake Saren in Therparkar district.




## PLANT COMMUNITIES

TWINSPAN analysis revealed following plant communities of the Keenjhar Site.

***1. Cyperus – Cynodon – Phyllanthus Plant Community (Fall 2006)***

This plant community is representative of relatively gravely grounds with lot of grasses and annuals. This plant community is highly relished by livestock; therefore, overgrazing was very common in places where this community was found. Associated flora over these sites included species like *Ipomoea* (shrubs), *P. juliflora, Cleome viscosa, Amaranthus sp., Corchorus trilocularis, Corchorus depressus, Indigofera hochsteteri, Blepharis, Atriplex sp., Euphorbia granulata, Euphorbia caducifolia, Acacia nilotica, Salvadora persica, Phyllanthus, Rhynchosia minima, Heliotropium sp., Oxystelma, Pentatropis spiralis, Achyranthis sp., Senra incana, Corchorus trilocularis, Coccinia,and Launaea sp.* Forage production of this plant community varied from 51 Kg/ha to 203 Kg/Ha.

***2. Zygophyllum – Grewia Plant Community (Fall 2006)***

This plant community present on raised grounds or embankments and occupied by plant species like *Euphorbia caducifolia, Prosopis Juliflora, Launaea procumbens, Pentatropis spiralis, Polygala erioptera, Polycarpaea spicata, Hibiscus scindicus, Convolvulus glomeratus, Aristida sp., Eragrostris, Tetrapogon tenellus, Corchorus sp., Lycium sp. Solanum cordatum, Solanum surattense, Oxystelma, Asparagus, Heliotropium sp., Digera muricata, Senra incana, Grewia tenax, Heliotropeum ophioglossum, Iphiona granitoides, Blepharis scindica, Maerua arenaria, Zygophylum propinquum, Argyrolobium roseum, Tavernaria cuneifolia, Aerva javanica* and, *Commicarpus boissieri.* Forage production of the sites represented by this plant community varied from 93 Kg/Ha to 194 Kg/Ha.

***3. Eragrostis – Cyperus – Zygophyllum Plant Community (Fall 2006)***

This plant community also represented the same sites as those in the *Zygophyllum – Grewia.* The sites were dominated with annuals, grasses and shrubs and comprised of gravely well-drained soils. Mostly these sites were overgrazed.

***4. Cynodon – Launaea Plant Community (Summer 2007)***

This community was represented on bench lands and plateaus. The associated plant species of this community included *Prosopis glandulosa, P. juliflora, Indigofera cordifolia, I. hochstetteri, I. oblongifolia, Pentatropis nivalis, Senra incana, Euphorbia caducifolia, Digera muricata, Corchorus depressus, C. tridens, Commicarpus boissieri, Zygophylum propinquum, Z. simplex, Commicarpus boissieri, Senna holosericea, Tribulus terrestris, Iphiona grantioides, Phyla nodiflora, Bacopa monnieri, Taverniera cuneifolia, Suaeda fruticosa, Amaranthus graecizans, Fagonia indica, Cleome scaposa, C. viscosa, Parkinsonia aculeata,* and *Salvadora persica.* In addition, the common grasses, consisted of species like *Aeluropus lagopoides, Aristida adscensionis, Brachiaria eruciformis, Cenchrus ciliaris, Cynodon dactylon, Dactyloctenium aegyptium, D. scindicum, Echinochloa colonna, Paspalum virginatum, Paspalidium germinatum,* and *Eragrostis japonica.* Forage production of these sites varied from 73 Kg/ha to 248 Kg/Ha showing overgrazing by livestock.

***5. Oxystelma – Fagonia Plant Community (Summer 2007)***

The associated plant species of these sites were represented by plants like *Prosopis juliflora, Euphrobia caducifolia, Acacia Senegal, Lycium edgeworthii, Commiphora stocksii, Grewia tenax* and *Iphionia grantioides.* The herbaceous cover comprised of *Rhynchosia minima, Heliotropium ophioglossum, Euphorbia granulata, E. clarkeana, Blepharis scindica, Indigofera hochstetteri, Corchorus depressus, C. tridens, Seddera latifolia, Boerhavia procumbens, Polygala erioptera, P. irregularis, Senna holosericea, Pentatropis spiralis, Cleome scaposa, Corbichonia decumbens, Indigofera oblongifolia, Convolvulus glomeratus, Cucumis prophetarum, Zygophyllum propinquum* and *Z. simplex*. The sedges and grass group was comprised of *Cyperus bulbosus, C. rotundus, Aristida adscensionis, Eragrostis ciliaris, Ochthochloa compressa Tragus roxburghii, Dichanthium annulatum, D. foveolatum* and *Cenchrus ciliaris. Forage production varied from 73 to 522 Kg/Ha.*

***6. Prosopis juliflora – Fagonia indica - Aristida adscensionis Plant Community (Spring 2008)***

This plant community was represented on hard ground dominated by gravels. *Polygonum effusum, Alhagi maurorum, Cressa cretica, Zygophyllum simplex, Heliotropium curassavicum, Prosopis glandulosa* and *Tamarix alii* were the associated species.

***7. Cynodon dactylon – Phyla nodiflora Plant Community (Spring 2008)***

This community represented sites which were occupied mainly by grasses and herbs, though some shrubs were also present. The dominant flora comprised of species like *Phyllanthus madraspatensis, Prosopis cineraria, Salvadora persica, Persicaria glabra, Launea procumbens, Sida ovata, Prosopis juliflora, Tamarix sp, Bulboschoenus affinis, Schoenoplectus litoralis, Heliotropium ovalifoilum, Rhynchosia minima, Cynodon dactylon,* associated species were *Cyperus articulatus, Paspalidium gemimatum, Persicaria glabra, Cyperus alopecuroides, Bacopa monnieri, Cyperus exaltatus, Alternenthera sessilis, Alhagi maurorum* and *Panicum turgidum.* Forage production varied from 420 to 612 Kg/Ha.

**Table 1. Cultivated plant species recorded at Keenjhar Lake**

| Sr # | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 1 | Boraginaceae | *Cordia myxa* L. | Phanerophyte | Small tree |
| 2 | Caesalpiniaceae | *Cassia alata* Linn. | Phanerophyte | Shrub |
| 3 | Caesalpiniaceae | *Parkinsonia aculeata* L. | Phanerophyte | Tree |
| 4 | Fabaceae | *Sesbania bispinosa* (Jacq.) W.F. Wight | Phanerophyte | Subshrub |
| 5 | Mimosaceae | *Leucaena leucocephala (Lam.)* ed Wit. | Phanerophyte | Tree |
| 6 | Moraceae | *Ficus benghalensis* L. | Phanerophyte | Tree |
| 7 | Moraceae | *Ficus religiosa* L. | Phanerophyte | Tree |
| 8 | Pedaliaceae | *Sesamum indicum* L. | Therophyte | Herb |
| 9 | Verbenaceae | *Clerodendrum inerme* Gaertn | Phanerophyte | Shrub |

## CONCLUSION

The vegetation in and around Keenjhar Lake is in the process of deterioration at a very fast pace. Although this ecosystem is rich in floral diversity with respect to number of species recorded (263 species). However, out of 87 species recorded in transects, there were 34 species in the category of rare and 35 species rated as vulnerable. This is indicative of the fact that this fresh water wetland ecosystem is loosing its productive potential. Immediate rehabilitation measures are required like control on overgrazing and discouraging alien plant species like *Eucalyptus* and *Mesquite* etc. The planting of fodder tree species and reseeding of palatable grasses should be promoted on farm fields through community participation in the area to overcome the grazing pressure.

**Table 2. List of Flora of Keenjhar Lake.**

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 1. | Acanthaceae | *Barleria acanthoides* Vahl | Phanerophyte | Shrub |
| 2. | Acanthaceae | *Barleria hochstettri* Nees | Chamaephyte | Shrub |
| 3. | Acanthaceae | *Barleria prionitis* L. | Phanerophyte | Shrub |
| 4. | Acanthaceae | *Blepharis sindica* Stocks ex. T. Anders. | Therophyte | Herb |
| 5. | Acanthaceae | *Ruellia patula* var. *alba* Saxton | Chamaephyte | Shrub |
| 6. | Aizoaceae | *Trianthema portulacastrum* L. | Therophyte | Herb |
| 7. | Aizoaceae | *Trianthema triquetra* Rottl. and Willd. | Therophyte | Herb |
| 8. | Aizoaceae | *Zaleya pentandra* (L.) Jeffery. | Chamaephyte | Herb |
| 9. | Amaranthaceae | *Achyranthes aspera* L. | Chamaephyte | Subshrub |
| 10. | Amaranthaceae | *Aerva javanica* (Burm.f.)Juss ex J.A. Schultes | Phanerophyte | Shrub |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 11. | Amaranthaceae | *Alternanthera sessilis* (L.) DC. | Chamaephyte | Herb |
| 12. | Amaranthaceae | *Amaranthus graecizans* L. | Therophyte | Herb |
| 13. | Amaranthaceae | *Amaranthus viridis* L. | Therophyte | Herb |
| 14. | Amaranthaceae | *Digera muricata* (L.) Mart. | Therophyte | Herb |
| 15. | Apocynaceae | *Rhazya stricta* Decne | Phanerophyte | Shrub |
| 16. | Araceae | *Pistia stratioites* L. | Hydrophyte | Herb |
| 17. | Arecaceae | *Nanorrhops ritcheana* (Griff.) Aitch. | Phanerophyte | Shrub |
| 18. | Arecaceae | *Phoenix sylvestris* L. | Phanerophyte | Tree |
| 19. | Aristolochiaceae | *Aristolochia bracteolata* Lamk. | Cryptophyte | Herb |
| 20. | Asclepiadaceae | *Calotropis procera* (Ait.) Ait.f. | Phanerophyte | Shrub |
| 21. | Asclepiadaceae | *Caralluma edulis* (Edgew.) Benth. & Hook. | Chamaephyte | Herb |
| 22. | Asclepiadaceae | *Glossonema varians* (Stocks) Hook.f. | Chamaephyte | Herb |
| 23. | Asclepiadaceae | *Leptadenia pyrotechnica* (Forsk.) Dcne. | Phanerophyte | Shrub |
| 24. | Asclepiadaceae | *Oxystelma esculentum* (L.f) R.Br. | Cryptophyte | Climbing herb |
| 25. | Asclepiadaceae | *Pentatropis nivalis* (J.F.Gmel.) Field & J.R.I.Wood | Chamaephyte | Climbing herb |
| 26. | Asparagaceae | *Asparagus dumosus* Baker | Cryptophyte | Shrub |
| 27. | Asteraceae | *Blumea obliqua* (L.) Druce | Chamaephyte | Herb |
| 28. | Asteraceae | *Conyza aegyptiaca* Ait. | Camaephyte | Herb |
| 29. | Asteraceae | *Echinops echinatus* Roxb. | Therophyte | Tall herb |
| 30. | Asteraceae | *Eclipta prostrata* (L.) L. | Chamaephyte | Herb |
| 31. | Asteraceae | *Grangea maderaspatana* (L.) Poir. | Therophyte | Herb |
| 32. | Asteraceae | *Iphiona grantioides* Boiss | Chamaephyte | Subshrub |
| 33. | Asteraceae | *Launaea procumbens* (Roxb.) Amin | Chamaephyte | Herb |
| 34. | Asteraceae | *Launaea remotiflora (DC.) Stebbins* | Therophyte | Herb |
| 35. | Asteraceae | *Pluchea arguta* Boiss. | Chamaephyte | Subshrub |
| 36. | Asteraceae | *Pluchea wallichiana* DC | Phanerophyte | Shrub |
| 37. | Asteraceae | *Pulicaria boissieri* Hook.f. | Chamaephyte | Herb |
| 38. | Asteraceae | *Sonchus asper* Fig. | Therophyte | Herb |
| 39. | Asteraceae | *Sonchus oleraceus* L. | Therophyte | Herb |
| 40. | Asteraceae | *Vernonia cinerascens* Schultz. Bip. | Phanerophyte | Shrub |
| 41. | Asteraceae | *Xanthium strumarium* L. | Phanerophyte | Shrub |
| 42. | Avicenniaceae | *Avicennia marina* L. | Phanerophyte | Tree |
| 43. | Boraginaceae | *Coldenia procumbens* L. | Chamaephyte | Herb |
| 44. | Boraginaceae | *Cordia gharaf* (Forsk.) Ehren. ex Asch. | Phanerophyte | Tree |
| 45. | Boraginaceae | *Heliotropium calcareum* Stocks | Chamaephyte | Subshrub |
| 46. | Boraginaceae | *Heliotropium crispum* Desf. | Chamaephyte | Subshrub |
| 47. | Boraginaceae | *Heliotropium curassavicum* L. | Chamaephyte | Herb |
| 48. | Boraginaceae | *Heliotropium ophioglossum* Stocks ex Boiss. | Chamaephyte | Herb |
| 49. | Boraginaceae | *Heliotropium ovalifolium* Forsk. | Chamaephyte | Herb |
| 50. | Boraginaceae | *Heliotropium strigosum* Willd. | Chamaephyte | Herb |
| 51. | Boraginaceae | *Sericostoma pauciflorum* Stocks ex Wight | Chamaephyte | Subshrub |
| 52. | Boraginaceae | *Trichodesma indicum* (L.) R. Br. | Chamaephyte | Subshrub |
| 53. | Brassicaceae | *Farsetia hamiltonii* Royle | Therophyte | Herb |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 54. | Burseraceae | *Commiphora stocksiana* (Engler) Engler | Phanerophyte | Large shrub – tree |
| 55. | Burseraceae | *Commiphora wightii* (Arn.) Bhandari | Phanerophyte | Shrub – tree |
| 56. | Caesalpiniaceae | *Senna holosericea* (Fresen.) Greuter | Chamaephyte | Subshrub |
| 57. | Caesalpiniaceae | *Senna italica* Mill. | Chamaephyte | Subshrub |
| 58. | Capparidaceae | *Cadaba fruticosa* (L.) Druce | Phanerophyte | Shrub |
| 59. | Capparidaceae | *Capparis decidua* (Forsk.) Edgew. | Phanerophyte | Large Shrub |
| 60. | Capparidaceae | *Capparis spinosa* L. | Phanerophyte | Subshrub |
| 61. | Capparidaceae | *Cleome brachycarpa* Vahl ex DC. | Chamaephyte | Herb |
| 62. | Capparidaceae | *Cleome scaposa* DC. | Therophyte | Herb |
| 63. | Capparidaceae | *Cleome viscosa* L. | Therophyte | Herb |
| 64. | Capparidaceae | *Gynandropsis gynandra* (L.) Briq. | Therophyte | Herb |
| 65. | Capparidaceae | *Maerua arenaria* (DC) Hook.f. & Thoms | Phanerophyte | Shrub |
| 66. | Caryophyllaceae | *Polycarpaea spicata* Wight & Arn. | Therophyte | Herb |
| 67. | Caryophyllaceae | *Spergularia marina* (L.) Griseb. | Therophyte | Herb |
| 68. | Chenopodiaceae | *Atriplex stocksii* Boiss. | Chamaephyte | Subshrub |
| 69. | Chenopodiaceae | *Chenopodium album* L. | Therophyte | Herb |
| 70. | Chenopodiaceae | *Chenopodium murale* L. | Therophyte | Herb |
| 71. | Chenopodiaceae | *Haloxylon stocksii* (Boiss.) Benth. & Hooker | Phanerophyte | Shrub |
| 72. | Chenopodiaceae | *Salsola imbricata* Forsk. | Phanerophyte | Shrub |
| 73. | Chenopodiaceae | *Suaeda fruticosa* Forsk. Ex J.F. Gmelin | Phanerophyte | Shrub |
| 74. | Convolvulaceae | *Convolvulus arvensis* L. | Chamaephyte | Twining herb |
| 75. | Convolvulaceae | *Convolvulus glomeratus* Choisy. | Chamaephyte | Twining herb |
| 76. | Convolvulaceae | *Convolvulus prostratus* Forssk. | Chamaephyte | Herb |
| 77. | Convolvulaceae | *Convolvulus rhyniospermus* Hochst. ex Choisy | Chamaephyte | Herb |
| 78. | Convolvulaceae | *Convolvulus scindicus* Boiss. | Chamaephyte | Subshrub |
| 79. | Convolvulaceae | *Cressa cretica* L. | Therophyte | Herb |
| 80. | Convolvulaceae | *Ipomoea aquatica* Forsk. | Hydrophyte | Herb |
| 81. | Convolvulaceae | *Ipomoea carnea* Jacq. | Phanerophyte | Large Shrub |
| 82. | Convolvulaceae | *Ipomoea sindica* Stapf | Therophyte | Climber |
| 83. | Convolvulaceae | *Merremia aegyptia* (L.) Urban | Therophyte | Climber |
|  | Convolvulaceae | *Merremia hederacea* (Burm.f.) Hall.f. | Chamaephyte | Climber |
| 84. | Convolvulaceae | *Seddera latifolia* Hochst. & Steud. | Chamaephyte | Subshrub |
| 85. | Cucurbitaceae | *Citrullus colocynthis* (L.) Schrad. | Therophyte | Herb |
| 86. | Cucurbitaceae | *Coccinia grandis* (L.) Voigt | Phanerophyte | Climber |
| 87. | Cucurbitaceae | *Cucumis melo* var. *agrestis* Naud. | Therophyte | Climber |
| 88. | Cucurbitaceae | *Cucumis prophetarum* L. | Chamaephyte | Climber |
| 89. | Cucurbitaceae | *Luffa echinata* Roxb. | Chamaephyte | Climber |
| 90. | Cucurbitaceae | *Mukia maderaspatana* (L.) M.J.Roem. | Chamaephyte | Climber |
| 91. | Cyperaceae | *Bolboschoenus affinis* (Roth.) Drobov | Cryptophyte | Sedge |
| 92. | Cyperaceae | *Bolboschoenus glaucus* (L.) S.G. Smith | Cryptophyte | Sedge |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 93. | Cyperaceae | *Cyperus alopecuroides* Rottb. | Cryphotphyte | Sedge |
| 94. | Cyperaceae | *Cyperus articulatus* L. | Cryptophyte | Sedge |
| 95. | Cyperaceae | *Cyperus exaltatus* L. | Cryptophyte | Sedge |
| 96. | Cyperaceae | *Cyperus bulbosus* Vahl. | Cryptophyte | Sedge |
| 97. | Cyperaceae | *Cyperus laevigatus* L. | Cryptophyte | Sedge |
| 98. | Cyperaceae | *Cyperus longus* L. | Cryptophyte | Sedge |
| 99. | Cyperaceae | *Cyperus pygmaeus* Rottb. | Hemicryptophyte | Sedge |
| 100. | Cyperaceae | *Cyperus rotundus* L. | Cryptophyte | Sedge |
| 101. | Cyperaceae | *Cyperus stoloniferus* Retz. | Cryptophyte | Sedge |
| 102. | Cyperaceae | *Eleocharis geniculata* (L.) Roem. & Schult. | Hemicryptophyte | Sedge |
| 103. | Cyperaceae | *Fimbristylis bisumbellata* (Forssk.) Bubani | Hemicryptophyte | Sedge |
| 104. | Cyperaceae | *Pycreus dwarkensis* (Sahni & Naithani) Hooper | Hemicryptophyte | Sedge |
| 105. | Cyperaceae | *Schoenoplectus litoralis* subsp *thermalis* (Trabut) S.Hooper | Crytophyte | Sedge |
| 106. | Elatinaceae | *Bergia suffruticosa* (Delile) Fenzl. | Chaemaephyte | Subshrub |
| 107. | Euphorbiaceae | *Euphorbia caducifolia* Haines | Phanerophyte | Large Shrub |
| 108. | Euphorbiaceae | *Euphorbia clarkeana* Hk.f. | Therophyte | Herb |
| 109. | Euphorbiaceae | *Euphorbia granulata* Forsk. | Therophyte | Herb |
| 110. | Euphorbiaceae | *Euphorbia hirta* L. | Therophyte | Herb |
| 111. | Euphorbiaceae | *Euphorbia serpens* Kunth | Therophyte | Herb |
| 112. | Euphorbiaceae | *Phyllanthus maderaspatensis* L. | Therophyte | Herb |
| 113. | Euphorbiaceae | *Phyllanthus reticulatus* Poir. | Phanerophyte | Shrub |
| 114. | Fabaceae | *Alhagi maurorum* Medic. | Phanerophyte | Subshrub |
| 115. | Fabaceae | *Alysicarpus ovalifolius* (Schumach.) J. Leonard | Therophyte | Herb |
| 116. | Fabaceae | *Argyrolobium roseum (Camb.)* Jaub. & Spach. | Therophyte | Herb |
| 117. | Fabaceae | *Crotalaria burhia* Ham. Ex Bth. | Phanerophyte | Subshrub |
| 118. | Fabaceae | *Crotalaria medicaginea* Lam. | Therophyte | Herb |
| 119. | Fabaceae | *Cyamopsis tetragonoloba* (L.) Taub. | Therophyte | Herb |
| 120. | Fabaceae | *Indigofera argentea* Burm.f. | Chamaephyte | Herb |
| 121. | Fabaceae | *Indigofera cordifolia* Heyne ex Roth | Therophyte | Herb |
| 122. | Fabaceae | *Indigofera hochstetteri* Baker | Therophyte | Herb |
| 123. | Fabaceae | *Indigofera linifolia* (L.f.) Retz. | Therophyte | Herb |
| 124. | Fabaceae | *Indigofera oblongifolia* Forsk. | Phanerophyte | Shrub |
| 125. | Fabaceae | *Rhynchosia minima* (L.) DC. | Chamaephyte | Climber |
| 126. | Fabaceae | *Melilotus alba* Desr. | Therophyte | Herb |
| 127. | Fabaceae | *Melilotus indica* (L.) All. | Therophyte | Herb |
| 128. | Fabaceae | *Taverniera cuneifolia* (Roth.) Arnott | Phanerophyte | Subshrub |
| 129. | Fabaceae | *Tephrosia purpurea* (L.) Pers. | Chamaephyte | Subshrub |
| 130. | Fabaceae | *Tephrosia strigosa* (Dalz.) Sant. & Mahcshw. | Therophyte | Herb |
| 131. | Fabaceae | *Trifolium alexandrianum* L. | Therophyte | Herb |
| 132. | Fabaceae | *Trifolium fragiferum* Linn | Therophyte | Herb |
| 133. | Fabaceae | *Vigna trilobata* (L.) Verdc. | Therophyte | Herb |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 134. | Gentianaeae | *Enicostemma hyssopifolium* (Willd.) Verdoon | Hemicryptophyte | Herb |
| 135. | Hydrocharitaceae | *Hydrilla verticillata* (L.f.) Royle | Hydrophyte | Herb |
| 136. | Illecebraceae | *Cometes surattensis* L. | Therophyte | Herb |
| 137. | Lamiaceae | *Salvia santolinifolia* Boiss. | Chamaephyte | Subshrub |
| 138. | Malvaceae | *Abutilon bidentatum* A. Rich. | Phanerophyte | Subshrub |
| 139. | Malvaceae | *Abutilon fruticosum* Guill.& Perr | Phanerophyte | Subshrub |
| 140. | Malvaceae | *Abutilon indicum* (Linn.) Sweet | Phanerophyte | Subshrub |
| 141. | Malvaceae | *Abutilon muticum* (Del.ex DC.) Sweet | Phanerophyte | Subshrub |
| 142. | Malvaceae | *Hibiscus micranthus* L.f. | Chamaephyte | Subshrub |
| 143. | Malvaceae | *Hibiscus scindicus* Stocks | Chaemaephyte | Subshrub |
| 144. | Malvaceae | *Pavonia Arabica* Hochst. & Steud. | Chamaephyte | Subshrub |
| 145. | Malvaceae | *Senra incana* Cav. | Phanerophyte | Subshrub |
| 146. | Malvaceae | *Sida ovata* Forssk. | Phanerophyte | Subshrub |
| 147. | Mimosaceae | *Acacia nilotica* (L.) Del. subsp. *Indica* (Benth.) Branan | Phanerophyte | Tree |
| 148. | Mimosaceae | *Acacia senegal* (L.)Willd. | Phanerophyte | Tree |
| 149. | Mimosaceae | *Prosopis cineraria* (Linn.) Druce. | Phanerophyte | Tree |
| 150. | Mimosaceae | *Prosopis glandulosa* Torr. | Phanerophyte | Large Shrub |
| 151. | Mimosaceae | *Prosopis juliflora* Swartz | Phanerophyte | Large Shrub |
| 152. | Molluginaceae | *Corbichonia decumbens* (Forsk.) Exell | Therophyte | Herb |
| 153. | Molluginaceae | *Gisekia Pharnaceodies* L. | Therophyte | Herb |
| 154. | Molluginaceae | *Glinus lotoides* (L.) O.Kuntze. | Chamaephyte | Herb |
| 155. | Molluginaceae | *Limeum indicum* Stocks ex. T. And. | Chamaephyte | Herb |
| 156. | Najadaceae | *Najas minor* All. | Hydrophyte | Herb |
| 157. | Nelumbonaceae | *Nelumbo nucifera* Gaertn. | Hydorphyte | Herb |
| 158. | Nyctaginaceae | *Boerhavia procumbens* Banks ex Roxb. | Cryptophyte | Herb |
| 159. | Nyctaginaceae | *Commicarpus boissieri* (Heimerl) Cufod. | Phanerophyte | Herb |
| 160. | Nymphaeaceae | *Nymphaea lotus* Hook. f. & Thoms. | Hydrophyte | Herb |
| 161. | Plumbaginaceae | *Limonium stocksii* (Boiss.) O.Kuntze | Chamaephyte | Subshrub |
| 162. | Poaceae | *Aeluropus lagopoides* (L.) Trin. Ex Thw. | Cryptophyte | Grass |
| 163. | Poaceae | *Aristida adscensionis* L. | Therophyte | Grass |
| 164. | Poaceae | *Aristida funiculata* Trin. & Rupr. | Therophyte | Grass |
| 165. | Poaceae | *Aristida mutabilis* Trin. & Rupr. | Therophyte | Grass |
| 166. | Poaceae | *Brachiaria ovalis* (R. Br.) Stapf | Therophyte | Grass |
| 167. | Poaceae | *Brachiaria ramosa* (L.) Stapf | Therophyte | Grass |
| 168. | Poaceae | *Brachiaria reptans* (L.) Gardner & Hubbard | Therophyte | Grass |
| 169. | Poaceae | *Cenchrus ciliaris* L. | Hemicryptophyte | Grass |
| 170. | Poaceae | *Cenchrus pennisetiformis* Hochst. & Steud. ex Steud | Hemicryptophyte | Grass |
| 171. | Poaceae | *Cenchrus setigerus* Vahl. | Hemicryptophyte | Grass |
| 172. | Poaceae | *Chloris barbata* Sw. | Haemicryptophyte | Grass |
| 173. | Poaceae | *Chrysopogon aucheri* (Boiss.) Stapf | Hemicryptophyte | Grass |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 174. | Poaceae | *Cymbopogon jwarancusa* (Jones) Schult. | Hemicryptophyte | Grass |
| 175. | Poaceae | *Cynodon dactylon* (L.) Pers. | Hemicryptophyte | Grass |
| 176. | Poaceae | *Dactyloctenium aegyptium* (L.) Willd | Therophyte | Grass |
| 177. | Poaceae | *Dactyloctenium aristatum* Link | Therophyte | Grass |
| 178. | Poaceae | *Dactyloctenium scindicum* Boiss. | Hemi cryptophyte | Grass |
| 179. | Poaceae | *Desmostachya bipinnata* (L.) Stapf | Cryptophyte | Grass |
| 180. | Poaceae | *Dichanthium annulatum* (Forsk.) Stapf | Hemicryptophyte | Grass |
| 181. | Poaceae | *Dichanthium foveolatum* (Del.) Roberty | Hemicryptophyte | Grass |
| 182. | Poaceae | *Diplachne fusca* (L.) P.Beauv. ex Roem & Schult. | Cryptophyte | Grass |
| 183. | Poaceae | *Echinochloa colonum* (L.) Link | Therophyte | Grass |
| 184. | Poaceae | *Eleusine indica* (Linn.) Gaertn. | Therophyte | Grass |
| 185. | Poaceae | *Elionurus royleanus* Nees ex A.Rich. | Therophyte | Grass |
| 186. | Poaceae | *Eragrostis cilianensis* (All.) Lut. ex F.T. Hubbard | Therophyte | Grass |
| 187. | Poaceae | *Eragrostis ciliaris* (L.) R. Br. | Therophyte | Grass |
| 188. | Poaceae | *Eragrostis japonica* (Thunb.) Trin. | Therophyte | Grass |
| 189. | Poaceae | *Eragrostis minor* Host | Therophyte | Grass |
| 190. | Poaceae | *Eragrostis pilosa* (L.) Beauv. | Therophyte | Grass |
| 191. | Poaceae | *Eragrostis tenella* (L.) P. Beauv. ex Roem. | Therophyte | Grass |
| 192. | Poaceae | *Eriochloa procera* (Retz.) C. E. Hubbard | Hemicryptophyte | Grass |
| 193. | Poaceae | *Lasiurus scindicus* Henr. | Hemicryptophte | Large Grass |
| 194. | Poaceae | *Leptothrium senegalensis* (Kunth) W.D. Clayton | Hemicryptophyte | Grass |
| 195. | Poaceae | *Ochthochloa compressa* (Forsk.) Hilu | Therophyte | Grass |
| 196. | Poaceae | *Panicum antidotale* Retz. | Hemicryptophyte | Grass |
| 197. | Poaceae | *Panicum turgidum* Forsk. | Hemicryptophyte | Grass |
| 198. | Poaceae | *Paspalidium flavidum* (Retz.) A. Camus | Hemicryphophyte | Grass |
| 199. | Poaceae | *Paspalidium geminatum* (Forsk.) Stapf | Hemicryptophyte | Grass |
| 200. | Poaceae | *Paspalum vaginatum* Swartz. | Hemicryptophyte | Grass |
| 201. | Poaceae | *Phragmites australis* (Cav.) Trin. | Cryptophyte | Large Grass |
| 202. | Poaceae | *Phragmites karka* (Retz.) Trin. ex Steud. | Cryptophyte | Large Grass |
| 203. | Poaceae | *Saccharum benghalense* Retz. | Hemicryptophyte | Large Grass |
| 204. | Poaceae | *Saccharum griffithii* Munro ex Boiss. | Hemicryptophyte | Large Grass |
| 205. | Poaceae | *Saccharum spontaneum* L. | Hemicryptophyte | Large Grass |
| 206. | Poaceae | *Sporobolus helvolus* (Trin.) Dur. & Schinz | Hemicryptophyte | Grass |
| 207. | Poaceae | *Sporobolus kentrophyllus* (K. Schum.) W.D. Clayton | Hemicryptophyte | Grass |
| 208. | Poaceae | *Sporobolus nervosus* Hochst. | Hemicryptophyte | Grass |
| 209. | Poaceae | *Sporobolus sp. nov.* | Hemicryptophyte | Grass |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 210. | Poaceae | *Tetrapogon tenellus* (Koen. Ex Roxb.) Chiov. | Therophyte | Grass |
| 211. | Poaceae | *Tragus roxburgii* Panigrahi | Therophyte | Grass |
| 212. | Poaceae | *Urochondra setulosa* (Trin.) C.E. Hubb. | Hemicryptophte | Grass |
| 213. | Polygalaceae | *Polygala erioptera* DC. | Therophyte | Herb |
| 214. | Polygalaceae | *Polygala irregularis* Boiss | Chamaephyte | Herb |
| 215. | Polygonaceae | *Persicaria glabra* (Willd.) Gomes de la Maza | Phanerophyte | Herb |
| 216. | Polygonaceae | *Polygonum effusum* Meisn | Chamaephyte | Herb |
| 217. | Polygonaceae | *Polygonum plebejum* R. Br. | Chamaephyte | Herb |
| 218. | Polygonaceae | *Rumex dentatus* L. | Therophyte | Herb |
| 219. | Pontederiaceae | *Eichhornia crassipes* (Mart.) Solma | Hydrophyte | Herb |
| 220. | Portulacaceae | *Portulaca oleracea* L. | Therophyte | Herb |
| 221. | Potamogetonaceae | *Potamogeton lucens* L. | Hydrophyte | Herb |
| 222. | Potamogetonaceae | *Potamogeton natans* L. | Hydrophyte | Herb |
| 223. | Potamogetonaceae | *Potamogeton perfoliatus* L. | Hydrophyte | Herb |
| 224. | Rhamnaceae | *Ziziphus nummularia* (Burm.f.) Wight & Arn. | Phanerophyte | Shrub |
| 225. | Rubiaceae | *Kohautia retrorsa* (Boiss.) Bremek. | Phanerophyte | Subshrub |
| 226. | Salicaceae | *Populus euphratica* Olivier | Phanerophyte | Tree |
| 227. | Salvadoraceae | *Salvadora oleoides* Decne. | Phanerophyte | Tree |
| 228. | Salvadoraceae | *Salvadora persica* L. | Phanerophyte | Tree |
| 229. | Salviniaceae | *Salvinia molesta* Mitchelle | Hydrophyte Fern | Herb |
| 230. | Scrophulariaceae | *Anticharis linearis* (Benth.) Hochst. ex Aschers. | Therophyte | Herb |
| 231. | Scrophulariaceae | *Bacopa monnieri* (L.) Wettstein | Chamaephyte | Herb |
| 232. | Scrophulariaceae | *Schweinfurthia papilionacea* (L.) Merrill | Chamaephyte | Herb |
| 233. | Solanaceae | *Datura fastuosa* L. | Phanerophyte | Shrub |
| 234. | Solanaceae | *Lycium edgeworthii* Dunal | Phanerophyte | Shrub |
| 235. | Solanaceae | *Physalis divaricata* D. Don | Therophyte | Herb |
| 236. | Solanaceae | *Physalis peruviana* L. | Therophyte | Herb |
| 237. | Solanaceae | *Solanum cordatum* Forssk. | Phanerophyte | Straggling Shrub |
| 238. | Solanaceae | *Solanum nigrum* L. | Therophyte | Herb |
| 239. | Solanaceae | *Solanum surattense* Burm.f. | Chamaephyte | Herb |
| 240. | Solanaceae | *Withania somnifera* (L.) Dunal | Phanerophyte | Subshrub |
| 241. | Tamaricaceae | *Tamarix alii* Qaiser | Phanerophyte | Shrub |
| 242. | Tamaricaceae | *Tamarix indica* L. | Phanerophyte | Shrub |
| 243. | Tamaricaceae | *Tamarix pakistanica* Qaiser | Phanerophyte | Shrub |
| 244. | Tamaricaceae | *Tamarix passernioides* Del. ex Desv. | Phanerophyte | Shrub |
| 245. | Tamaricaceae | *Tamarix sarenensis* Qaiser | Phanerophyte | Shrub |
| 246. | Tamaricaceae | *Tamarix sp. Nov.* | Phanerophyte | Shrub |
| 247. | Tiliaceae | *Corchorus aestuans* L. | Therophyte | Subshrub |
| 248. | Tiliaceae | *Corchorus depressus* (L.) Stocks | Chamaephyte | Herb |
| 249. | Tiliaceae | *Corchorus tridens* L. | Therophyte | Herb |
| 250. | Tiliaceae | *Corchorus trilocularis* L. | Therophyte | Herb |
| 251. | Tiliaceae | *Grewia erythraea* Schweinf | Phanerophyte | Shrub |

| S.# | Family | Plant species | Life form | Habit |
|---|---|---|---|---|
| 252. | Tiliaceae | *Grewia tenax* (Forssk.) A. & S. | Phanerophyte | Shrub |
| 253. | Tiliaceae | *Grewia villosa* Willd. | Phanerophyte | Shrub |
| 254. | Typhaceae | *Typha dominghensis* Pers. | Cryptophyte | Reed |
| 255. | Verbenaceae | *Phyla nodiflora* (L.) Greene | Chamaephyte | Herb |
| 256. | Violaceae | *Viola stocksii* Boiss. | Therophyte | Herb |
| 257. | Zygophyllaceae | *Fagonia indica* Burm.f. | Chamaephyte | Herb |
| 258. | Zygophyllaceae | *Tribulus longipetalus* Viv. | Therophyte | Herb |
| 259. | Zygophyllaceae | *Tribulus ochroleucus* (Maire) Ozenda & Quezel | Therophyte | Herb |
| 260. | Zygophyllaceae | *Tribulus terrestris* L. | Therophyte | Herb |
| 261. | Zygophyllaceae | *Zygophyllum propinquum* Decne. | Chamaephyte | Subshrub |
| 262. | Zygophyllaceae | *Zygophyllum simplex* L. | Therophyte | Herb |

## REFERENCES


Ali, S. I. and Y. J. Nasir (1989-1991). *Flora of Pakistan*. fascicle nos. 191-193. Department of Botany, University of Karachi, and PARC, Islamabad.

Ali, S. I. and M. Qaiser (1992-1998). *Flora of Pakistan*. fascicle nos. 194-201. Department of Botany, University of Karachi.

Ali, S. I. and M. Qaiser (2000-2007). *Flora of Pakistan*. fascicle nos. 202-210. Department of Botany, University of Karachi and Missouri Botanical Garden, St. Louis.

Anon. (1999). *Report on study into causes and effects of eutrophication in major Lakes in Sindh*. Environmental Protection Agency, Government of Sindh.

Anon. (1968). *Determination of Forage Production.* Leaflet No. 1. Range Management Branch. Division of Forestry Research. Pakistan Forest Institute, Peshawar.pp:10.

Anon. (1962). *Range Research. Basic Problems and Techniques*. National Academy of Sciences –National Research Council. Publication 890. Washington, D.C. USA.

Batanouny, K. H. (1981). *Ecology and Flora of Qatar*. Centre for scientific and applied Research, University of Qatar, P.O. Box 2713, Doha.

Bhandhari, M. M. (1978). *Flora of Indian Desert*. Scientific Publishers, Jodhpur.

Bonham, C. D. (1989). *Measurements of Terrestrial Vegetation*. John Wiley & Sons. New York.

Boulos, L. (1991). *Flora of Egypt*. Al Hadara Publishing Cairo, Egypt, Vol. 1.

Canfield, R. H. (1940). Application of line interception method in sampling range vegetation. *Jour. For*., 23: 388-394.

Chul, K. S. and K. Moody (1983). Comparison of some methodologies for vegetation analysis in transplanted rice. *Korean J. Crop. Sci.*, 28(3):310-318

Cook, C. W. and J. Stubbendieck (eds.) (1986). *Range Research. Basic Problems and Techniques*. Society for Range Management. Colorado, USA.

Dasti, A. and A. D. Q. Agnew (1994). The vegetation of Cholistan and Thal deserts, Pakistan. *J. Arid. Environ*., 27: 193-208.

ESCAP, (1994). *Range Management Manual for Asia and Pacific*. Economic and Social Commission for Asia and the Pacific (ESCAP), United Nations, New York.

Holechek, R. K. and D. D. Briske (1991). An ecological perspective, p. 11-26. In: R. K. Heitschmidt and J.W. Stuth (eds.). *Grazing Management. Principles & Practices*. Prentice Hall, Englewood Cliffs, New Jersey, USA.

Jafri, S. M. H. (1966). *The Flora of Karachi*. The Book Corporation, Karachi, Pakistan.

Kent, M. and P. Coker (1992). *Vegetation description and analysis: A Practical Approach*. CRC Press, Boca Ratan Ann Arber and Belhaven Press London.

Khan, D., R. Ahmad and S. Ismail (1989). Structure, composition, and aboveground standing phytomass of some grazable grass-dominated communities of Pakistan coast. *Pak. J. Bot*., 21(1): 88-106.

Marwat, Q., F. Hussain and T. M. Khilji (1990). Phyto-ecology of the vegetation of Zangilora area Quetta. Balochistan. *Pak. J. Agric. Res*., 11(4): 275-283.

Matthew, K. M. (1981-3). *Flora of Tamilnadu Carnatic, The Rapinat Herbarium*. St. Joseph's College, Tiruchirapalli 620002, India, 1-3.

Michael, A. A. (1967). *The Indus River: A Study of the Effects of Partition*. New Haven, CT: Yale University Press, London, 328 pp.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. Willey & Sons, New York, pp: 547.

Nasir, E. and S. I. Ali (Eds.). (1970-1989). *Flora of Pakistan* (fascicles series 1-190). University of Karachi, Pakistan.

Qureshi, R. (2004). *Floristic and Ethno botanical Study of Desert Nara Region, Sindh*. Department of Botany, Shah Abdul Latif University, Khairpur, Sindh, Pakistan. Ph.D. Thesis, Vol. I: 1-300.

Rashid, W., M. Ahmad, G. Akbar., M. Khan., K. N. Babar and A. Qayyum (1988). A preliminary study of the vegetation of Rawal experimental sub-catchment area. Pak. J. Sci. Ind. Res., 31(12):848-851.

Saeed Ahmad., M. H. Bokhari, A. A. Dasti and A. Hanan (1987). Phyto-ecological studies of sand dunes vegetation near Muzaffargarh. In: Ihsan Ilahi and Farrukh Hussain eds. Modern Trends of Plant Science Research in Pakistan. *Proceedings of 3rd National Conference of Plant Scientists*. November 7-11, 1987. Department of Botany, University of Peshawar. pp: 29-34.

Shaukat, S. S., A. Khairi and R. Ahmad (1976). A Phytosociological study of Gadap area, southern Sind, Pakistan. *Pak. J. Bot*., 8(2): 133-149.

Shetty, B. V. and V. Singh (1987 & 1991). *Flora of Rajasthan*. Botanical Survey of India. Old Connaught Place Dehra Dun. Vol. I & II.

Shukla, S. K. and P. K. Srivastava (1992). *Environmental Wildlife Impact Analysis*. Common Wealth Publisher, New Delhi, India.

Singh, M. P., B. S. Singh, and S. Dey (2002). *Plant Biodiversity & Taxonomy: Phytosociological Region of Gangetic plains*. Daya publishing House, Delhi-110035, 105-107.

Smith, R. L. (1974). *Ecology and field biology*. 2nd Edition, Harper & Row Publishers, Inc., 10 East 53rd Street, New York, N.Y. 10022, 692-703.

Thalen, D. C. P. and W. Junk (1979). *Ecology and utilization of desert shrub rangelands in Iraq*. BV Publ. The Hague. ISBN 90-6193-593-8.pp:44-241.

Wahid, A. (1990). *Dietary composition and nutritional status of sheep and goats grazing two rangeland types in Balochistan*. Ph.D. Dissertation. Department of Rangeland Resources, Oregon State USA.

(*Accepted for publication June 2010*)