

Phyto-Sociological Studies in Chhumbi Surla Wildlife Sanctuary, Chakwal, Pakistan. I. Species Diversity

A. ALEEM CHAUDHRY, MANSOOR HAMEED, RIAZ AHAMD AND ANWAR HUSSAIN
Punjab Wildlife Research Institute, Faisalabad, Pakistan

ABSTRACT

Reconnaissance survey of plant diversity was conducted in the Chhumbi Surla Wildlife Sanctuary, Chakwal during August 1995. Vegetation type is predominantly sub-tropical scrub forest, where plant species numbered 116 belonged to 35 families; Poaceae was the largest family with 41 grass species. Five plant communities were identified within the core area, and two in the peripheral area. *Chrysopogon serrulatus* was the dominant species of all the plant communities. Other major species were *Dactyloctenium scindicum*, *Cymbopogon jwarancusa*, *Sporobolus ioclados*, *Digitaria sanguinalis* and *Dichanthium foveolatum* among grasses; *Acacia modesta*, *Dodonaea viscosa* and *Justicia adhatoda* among trees/large shrubs, and *Lespedeza floribunda*, *Pupalia lappacea* and *Dichyptera bupleuroides* among under-shrubs/herbs. Data for density, frequency and cover for all the plant species were recorded to determine their importance value. Punjab urial (*Ovis vignei punjabiensis*) habitat was extremely rich with regard to the palatable grass and dicot species ensuring ample food supply but there is a need to improve the status of useful trees and large shrubs like *Olea ferruginea*, *Dodonaea viscosa*, *Maytenus royleanus* and *Ziziphus nummularia* with regard to shelter, nesting and food variety for many wildlife species, especially Punjab urial, francolins and other partridges.

Key Words: Wildlife; Pakistan; Species diversity

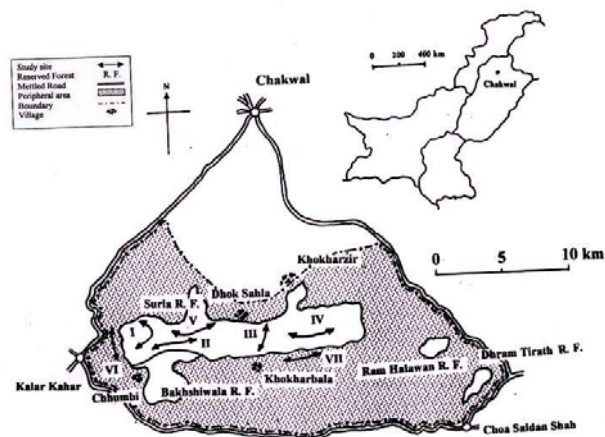
INTRODUCTION

The Chhumbi Surla Wildlife Sanctuary is spread over an area of 138,840 acres including 15,000 acres of state forest. It is one of the last strongholds of the Punjab urial (*Ovis vignei punjabiensis*) population. Black and grey francolins (*Francolinus francolinus* and *F. pondicerianus* respectively) are the other important game species. The core area consists of natural subtropical thorn scrub forests, Surla and Bhukhshi Wala Reserved Forests. Ram Halawan and Dharam Terath Reserved Forests are other forest patches (Fig. 1). The peripheral areas, the shamlat, are jointly owned by local inhabitants and used as grazing land. Their utilization is much beyond the grazing capacity levels, thus affecting the vegetation and wildlife in the area. Some important villages of the area are Bhaun, Khokar Bala, Dhariale Kahoon, Dulumial, Dhok Ban Amir Khatoon, Therpal, Bhalla, Kariala, Wariamal, Khokharzir and Khai. Vegetation of forest and peripheral areas is contrasting, as the grazing pressure is very high in peripheral areas. Forests are still rich in biodiversity of both plants and animals but the number of plant species in the periphery is considerably low as compared to forest areas or core areas.

Peripheral area is highly undulating and cultivation is possible only in about 30% of the area. Kahoon valley on the southern side of the forest is most extensively cultivated. Some areas around Dhok Ban Amir Khatoon, Therpal, Bhalla, Kariala, Khokharzir and Khai are also under cultivation. Major crops of the area are wheat, sorghum, maize, barley, millets, guara, peanut and some oil seeds like mustard and raya.

The condition of forests and shamlat is quite

Fig. 1. Map of Chhumbi Surla Wildlife Sanctuary showing sites of phyto-social studies



contrasting with regard to vegetation status. Vegetation within the core area is very dense with greatly overlapping stratification. A variety of tree, shrub, herb and grass species can be seen in the core area; whereas, there are hardly any large trees in the peripheral area. The present study was conducted with a view to undertaking a detailed survey of Punjab urial habitat and to promoting efforts in the protection of the habitat and population of the endangered wildlife of the area.

MATERIALS AND METHODS

A detailed survey was undertaken to explore the fauna and flora of Chhumbi Surla Wildlife Sanctuary, Chakwal during August 1995. Vegetation was studied at five

relatively homogenous sites within the core forest areas and at two sites in the peripheral area (Fig. 1). For the nomenclature and identification of plant species Flora of Pakistan (Nasir & Ali, 1970-90) was followed. Seven sites were selected on the basis of slope, aspect, soil texture and habitat type for the study of vegetation type/ structure and the number of plant species. Ten quadrats, each of 25 m² for shrubs/ trees and ten each of 1 m² for undershrubs/ herbs/ grasses, were laid at each study site along a transect line, separated by 20 m from each other. Each one m² quadrat was laid in the fixed corner of 25 m² quadrat. Data on density, frequency and cover of each species were recorded following Hussain (1983) and used to compute their importance value.

RESULTS AND DISCUSSION

During the survey of Chhumbi Surla Wildlife Sanctuary, 116 plant species were recorded belonging to 35 families as shown in Table I. The largest family was Poaceae with 40 grass species, while other major families were Cyperaceae (ten species) and Papilionaceae (seven species). The area was predominantly occupied by grasses species like *Chrysopogon serrulatus*, *Dactyloctenium scindicum*, *Cymbopogon jwarancusa*, *Dactyloctenium scindicum*, *Sporobolus ioclados*, *Digitaria sanguinalis* and *Dichanthium foveolatum* with some dicot species like *Acacia modesta*, *Dodonaea viscosa*, *Justicia adhatoda*, *Lespedeza floribunda* and *Diclyptera bupleuroides*. In the peripheral area *Cynodon dactylon*, *Imperata cylindrica*, *Chrysopogon serrulatus*, *Saccharum spontaneum* and

Table I. Floral list of Chhumbi-Surla Wildlife Sanctuary, Chakwal (August 1995)

Family	Species Number	Plant species
Acanthaceae	2	<i>Diclyptera bupleuroides</i> , <i>Justicia adhatoda</i>
Aizoaceae	1	<i>Trianthema portulacastrum</i>
Amaranthaceae	3	<i>Aerva javanica</i> , <i>Digera muricata</i> , <i>Pupalia lappacea</i>
Apocynaceae	1	<i>Nerium oleander</i>
Araliaceae	1	<i>Hedera nepalensis</i>
Asclepiadaceae	4	<i>Calotropis procera</i> , <i>Cynanchum auriculatum</i> , <i>Periploca aphylla</i> , <i>Periploca hydaspidis</i>
Boraginaceae	3	<i>Cynoglossum lanceolatum</i> , <i>Heliotropium rariflorum</i> , <i>Trichodesma indicum</i>
Cactaceae	1	<i>Opuntia monacantha</i>
Capparidaceae	3	<i>Capparis decidua</i> , <i>Capparis spinosa</i> , <i>Cleome scaposa</i>
Celastraceae	1	<i>Maytenus royleanus</i>
Chenopodiaceae	2	<i>Chenopodium album</i> , <i>Salicornia brachiata</i>
Commelinaceae	1	<i>Commelina albescens</i>
Compositae	4	<i>Bidens pilosa</i> , <i>Cnicus arvensis</i> , <i>Launaea procumbens</i> , <i>Vernonia cinerascens</i>
Convolvulaceae	3	<i>Evolvulus alsinoides</i> , <i>Ipomoea carnea</i> , <i>Ipomoea eriocarpa</i>
Cucurbitaceae	1	<i>Corallocarpus epigaeus</i>
Cyperaceae	10	<i>Cyperus compressus</i> , <i>Cyperus iria</i> , <i>Cyperus niveus</i> , <i>Cyperus rotundus</i> , <i>Kyllinga triceps</i> , <i>Scirpus littoralis</i> , <i>Scirpus maritimus</i> , <i>Scirpus michelianus</i> , <i>Scirpus mucronatus</i> , <i>Scirpus roylei</i>
Euphorbiaceae	1	<i>Euphorbia clarkeana</i>
Labiatae	1	<i>Leucas mutans</i> , <i>Ostostegia limbata</i>
Liliaceae	1	<i>Asparagus adscendens</i>
Malvaceae	2	<i>Abutilon fruticosum</i> , <i>Malvastrum coromandelianum</i>
Mimisaceae	3	<i>Acacia hydaspica</i> , <i>Acacia modesta</i> , <i>Prosopis glandulosa</i>
Nyctaginaceae	1	<i>Boerhavia procumbens</i>
Oleaceae	1	<i>Olea ferruginea</i>
Oxalidaceae	1	<i>Oxalis corniculata</i>
Papilionaceae	8	<i>Argyrolobium stenophyllum</i> , <i>Astragalus psilocentros</i> , <i>Butea monosperma</i> , <i>Lespedeza floribunda</i> , <i>Lespedeza juncea</i> , <i>Lotus corniculatus</i> , <i>Rhynchosia capitata</i>
Plantaginaceae	1	<i>Plantago major</i>
Poaceae	41	<i>Acrachne racemosa</i> , <i>Aristida adscensionis</i> , <i>Aristida mutabilis</i> , <i>Brachiaria deflexa</i> , <i>Brachiaria ramosa</i> , <i>Cenchrus pennisetiformis</i> , <i>Cenchrus setigerus</i> , <i>Chrysopogon serrulatus</i> , <i>Cymbopogon jwarancusa</i> , <i>Cynodon dactylon</i> , <i>Dactyloctenium aegyptium</i> , <i>Dactyloctenium scindicum</i> , <i>Desmostachya bipinnata</i> , <i>Dichanthium annulatum</i> , <i>Dichanthium foveolatum</i> , <i>Digitaria ciliaris</i> , <i>Digitaria sanguinalis</i> , <i>Echinochloa colona</i> , <i>Echinochloa crus-galli</i> , <i>Enneapogon persicus</i> , <i>Eragrostis cilianensis</i> , <i>Eragrostis minor</i> , <i>Eragrostis pilosa</i> , <i>Hemarthria compressa</i> , <i>Heteropogon contortus</i> , <i>Hordeum murinum</i> , <i>Imperata cylindrica</i> , <i>Ochthochloa compressa</i> , <i>Panicum atrosanguineum</i> , <i>Panicum miliaceum</i> , <i>Paspalum paspaloides</i> , <i>Phragmites karka</i> , <i>Rhynchelytrum repen</i> , <i>Saccharum bengalense</i> , <i>Saccharum spontaneum</i> , <i>Setaria viridis</i> , <i>Sorghum halepense</i> , <i>Sporobolus coromandelianus</i> , <i>Sporobolus ioclados</i> , <i>Stipagrostis hirtigluma</i> , <i>Tragus roxburghii</i>
Polygalaceae	2	<i>Polygala arvensis</i> , <i>Polygala erioptera</i>
Polypodiaceae	1	<i>Adiantum capillus-veneris</i>
Rhamnaceae	2	<i>Rhamnus pentapomica</i> , <i>Ziziphus nummularia</i>
Sapindaceae	2	<i>Dodonaea viscosa</i>
Solanaceae	2	<i>Solanum incanum</i> , <i>Solanum surattense</i>
Verbenaceae	2	<i>Lantana camara</i> , <i>Lantana indica</i>
Typhaceae	1	<i>Typha domingensis</i>
Zygophyllaceae	2	<i>Fagonia indica</i> , <i>Tribulus terrestris</i>

Cyperus niveus were the dominant species.

Each of the seven sites (shown in Fig. 1) belongs to a specific community as presented in Table II along with their distinct ecological features like soil characteristics, topography, etc.

Site I. *Chrysopogon serrulatus* - *Heteropogon contortus* community. Tops of the hills on western side of the wildlife sanctuary were more or less flattened where 43 plant species were recorded. Vegetation mainly comprised of *Chrysopogon serrulatus* with some frequent nutritious palatable grasses like *Heteropogon contortus* and *Dactyloctenium scindicum* (Cope, 1982). Other dominant grasses were *Sporobolus ioclados*, *Cymbopogon jwarancusa* and *Hordeum murinum* with some large *Acacia modesta* plants and patches of *Opuntia monacantha* and *Pupalia lappacea*. Vegetation cover was highly overlapping and hardly any bare land could be seen.

Site II. *Chrysopogon serrulatus* - *Dodonaea viscosa* community. Slopes in this habitat were the steepest (60o) where 37 plant species were noted. Major grass species was *Chrysopogon serrulatus* covering about 50% of the total vegetation while the other dominant grasses were *Desmostachya bipinnata*, *Sporobolus ioclados*, *Dactyloctenium scindicum*, *Cynodon dactylon*, *Heteropogon contortus* and *Dichanthium foveolatum*. Major shrubs / undershrubs were *Dodonaea viscosa*, *Acacia modesta*, *Opuntia monacantha* and *Lespedeza floribunda*. Vegetation cover was considerably thinner than that of site I having smaller *Acacia modesta* plants and few *Prosopis glandulosa* and no dominant herbaceous plant.

Site III. *Chrysopogon serrulatus* - *Sporobolus ioclados* community. Slopes were about 45% on the southwestern side where 34 plant species were collected. Vegetation mainly comprised of two grass species, *Chrysopogon serrulatus* and *Sporobolus ioclados* with some frequent excellent fodder grasses like *Dichanthium foveolatum*, *Dactyloctenium scindicum* and *Cenchrus pennisetiformis*

(Cope, 1982; Chaudhary, 1989). Plants of *Acacia modesta* were very small and covered a small portion of land. *Lespedeza floribunda* frequently occurred with few plants of *Capparis decidua*. Herbaceous species were rarely recorded.

Site IV. *Chrysopogon serrulatus*-*Cymbopogon jwarancusa* community. Site IV was selected within the valley on the southern side and 42 plant species were observed. Dominant grass species were *Chrysopogon serrulatus* and *Cymbopogon jwarancusa* with some other frequent species like *Sporobolus ioclados*, *Cenchrus pennisetiformis*, *Dactyloctenium scindicum*, *Digitaria sanguinalis*, *Heteropogon contortus* and *Saccharum spontaneum*. Excellent fodder species were *Cenchrus pennisetiformis*, *Heteropogon contortus* and *Dactyloctenium scindicum* (Cope, 1982). Large shrubs of *Acacia modesta*, frequent occurrence of *Dodonaea viscosa* and *Lantana indica* and tall tussocks of *Saccharum bengalense* and *Saccharum spontaneum* provide good shelter for urial and many bird species, especially francolins.

Site V. *Chrysopogon serrulatus*-*Justicia adhatoda* community. This site was selected in the valley on the eastern side of the wildlife sanctuary where soils were typically reddish sandy clay. Twenty-three species were recorded at this site. Vegetation predominantly comprised of grasses like *Chrysopogon serrulatus*, *Heteropogon contortus*, *Dichanthium foveolatum*, *Cymbopogon jwarancusa*, *Sporobolus ioclados*, *Cenchrus pennisetiformis*, *Ochthochloa compressa*, *Saccharum bengalense* and *Aristida mutabilis* and dicots like *Justicia adhatoda*, *Lespedeza floribunda* and *Acacia modesta*. Habitat was extremely rich in many palatable species like *Cenchrus pennisetiformis*, *Dichanthium foveolatum*, *Dactyloctenium scindicum*, *Heteropogon contortus* and *Ochthochloa compressa* (Cope, 1982; Chaudhary, 1989).

Table II. Description of study sites in the Chhumbi Surla Wildlife Sanctuary

Site	Species (Number)	Plant community	Slope	Aspect	Soil texture	Vegetation type	Habitat description
I	43	<i>Chrysopogon serrulatus</i>	0-15o	Western	Sandy clay with sand stones	Dominant grasses with few large shrubs	Flat top of the hill
II	37	<i>Chrysopogon serrulatus</i> - <i>Dodonaea viscosa</i>	60o	Northern	Mostly sand stones	Dominant grasses with small to medium-sized shrubs	Within the valley
III	34	<i>Chrysopogon serrulatus</i> - <i>Sporobolus ioclados</i>	45o	South-western	Mostly sand stones	Dominant grasses with small shrubs	Moderate slopes
IV	42	<i>Chrysopogon serrulatus</i> - <i>Cymbopogon jwarancusa</i>	60o	Northern	Mostly sand stones	Dominant grasses with tall trees and shrubs	Within the valley
V	23	<i>Chrysopogon serrulatus</i> - <i>Justicia adhatoda</i>	15o	Western	Mostly sand stones	Mixture of grasses and shrubs	Inside the valley
VI	33	<i>Cynodon dactylon</i> - <i>Chrysopogon serrulatus</i>	0-15o	Western	Sandy clay	Mixture of creeping and other grasses with few shrubs	More or less flattened peripheral area
VII	55	<i>Imperata cylindrica</i> - <i>Chrysopogon serrulatus</i>	0-15o	Southern	Sandy clay	Dominant grasses with few sedges and small shrubs	Uneven peripheral area

Site VI. *Cynodon dactylon*-*Chrysopogon serrulatus* community.

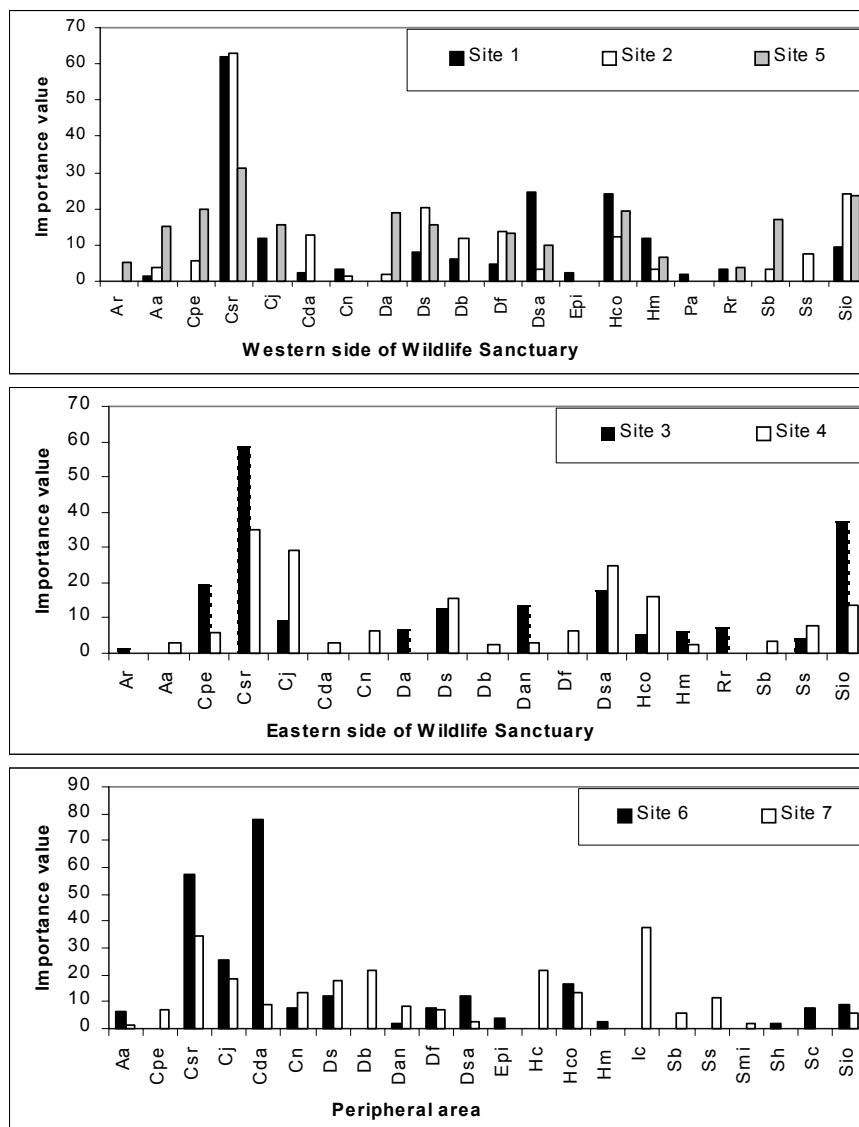
Western periphery of the wildlife sanctuary contained 33 species, where two grass species; *Cynodon dactylon* and *Chrysopogon serrulatus* dominated the area with few other species like *Heteropogon contortus*, *Dactyloctenium scindicum* and *Digitaria sanguinalis*. Only dominant dicot species was *Acacia modesta* having medium-sized plants. This habitat can be regarded as good pastureland as the most dominant species *Cynodon dactylon* is considered a first class fodder grass (Cope, 1982). High grazing pressure of cattle and goats eliminated all the dicot species and most of the grasses from the area but *Cynodon dactylon* survived because it is a high yielding palatable species and very resistant to grazing and trampling (White et al., 1959).

Site VII. *Imperata cylindrica*-*Chrysopogon serrulatus* community.

Maximum diversity of the plant species was recorded on this peripheral area. Study site was selected on the southern side of the main core area. Fifty-five species were noted at this site. Dominant grass species were *Imperata cylindrica*, *Chrysopogon serrulatus*, *Cymbopogon jwarancusa*, *Dactyloctenium scindicum*, *Cyperus niveus*, *Hordeum murinum*, *Heteropogon contortus* and *Saccharum spontaneum*. Not a single dicot species could be strictly regarded as the dominant species but small bushy plants of *Acacia modesta*, *Prosopis glandulosa* and *Ziziphus nummularia* were recorded here and there.

There was a great variability in all the habitats studied with regard to soil texture and form, topography, species structure and composition, making the wildlife sanctuary very suitable for many mammals and birds. Shrubs or trees like *Acacia modesta*, *Justicia adhatoda*, *Opuntia monacantha*, *Maytenus royleanus*, *Olea ferruginea*, *Butea monosperma*, *Ziziphus nummularia*, *Dodonaea viscosa*, *Lantana indica* are useful for nesting and shelter. Grasses

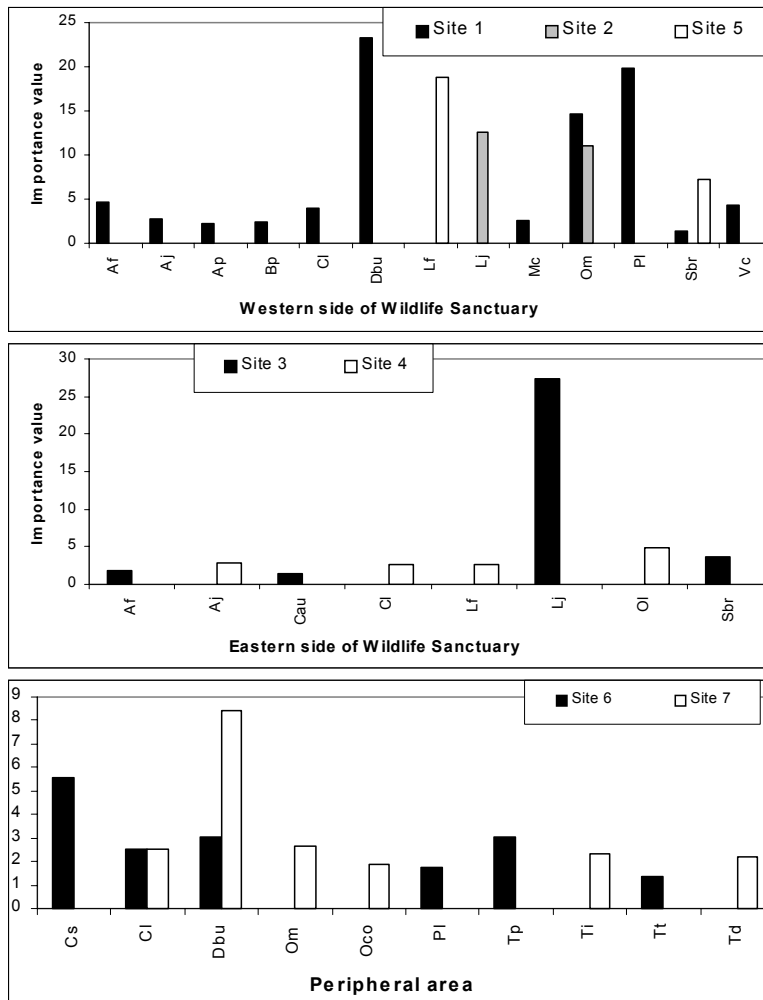
Fig. 2. Importance value of grass/sedge species recorded in Chhumbi-Surla Wildlife Sanctuary



Ar (*Acrachne racemosa*), Aa (*Aristida adscensionis*), Cpe (*Cenchrus pennisetiformis*), Csr (*Chrysopogon serrulatus*), Cj (*Cymbopogon jwarancusa*), Cda (*Cynodon dactylon*), Cn (*Cyperus niveus*), Da (*Dactyloctenium aegyptium*), Ds (*D. scindicum*), Db (*Desmostachya bipinnata*), Dan (*Dichanthium annulatum*), Df (*D. foveolatum*), Dsa (*Digitaria sanguinalis*), Epi (*Eragrostis pilosa*), Hc (*Hemarthria compressa*), Hco (*Heteropogon contortus*), Hm (*Hordeum murinum*), Ic (*Imperata cylindrica*), Pa (*Panicum atrosanguineum*), Rr (*Rhynchelytrum repens*), Sb (*Saccharum bengalense*), Ss (*S. spontaneum*), Smi (*Scirpus michelianus*), Sh (*Sorghum halepense*), Sc (*Sporobolus coromandelianus*) Sio (*S. ioclados*)

like *Arachne racemosa*, *Aristida adscensionis*, *Cenchrus pennisetiformis*, *Cenchrus setigerus*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Dactyloctenium scindicum*, *Dichanthium annulatum*, *Echinochloa colona*, *Echinochloa crus-galli*, *Enneapogon persicus*, *Eragrostis ciliansis*, *Eragrostis pilosa*, *Heteropogon contortus*, *Ochthochloa compressa*, *Panicum atrosanguineum*, *Panicum miliaceum*, *Tragus roxburghii* are considered fodder grasses (White et

Fig. 3. Importance value of under-shrub/herb species recorded in Chhumbi-Surla Wildlife Sanctuary



Af (*Abutilon fruticosum*), Aj (*Aerva javanica*), Ap (*Astragalus psilocentros*), Bp (*Bidens pilosa*), Cau (*Cynanchum auriculatum*), Cl (*Cynoglossum lanceolatum*), Cs (*Cleome scaposa*), Dbu (*Diclyptera bupleuroides*), Lf (*Lespedeza floribunda*), Lj (*Lespedeza juncea*), Mc (*Malvastrum coromandelianum*), Oco (*Oxalis corniculata*), Oi (*Otostegia limbata*), Om (*Opuntia monacantha*), Pl (*Pupalia lappacea*), Sbr (*Salicornia brachiata*), Td (*Typha domingensis*), Ti (*Trichodesma indicum*), Tp (*Trianthema portulacastrum*), Tt (*Tribulus terrestris*), Vc (*Verninia cinerascens*)

al., 1959; Cope, 1982; Chaudhary, 1989). Tussocks of *Saccharum spontaneum* and *Saccharum bengalense* are useful for francolin nesting and fruits of many species like *Ziziphus nummularia*, *Olea ferruginea*, *Periploca aphylla*, *Corralocarpus epigeus*, *Plantago major*, *Solanum incanum* are edible.

Fig. 2, 3 and 4 present a clear picture of dominant grasses, sedges and other dicot species. *Chrysopogon serrulatus* dominated all the vegetation study sites and its peripheral area among grasses with regard to importance value. Status of *Heteropogon contortus*, *Sporobolus ioclados*, *Saccharum spontaneum*, *Saccharum bengalense*, *Digitaria sanguinalis*, *Dichanthium foveolatum*, *Desmostachya bipinnata*, *Dactyloctenium scindicum*,

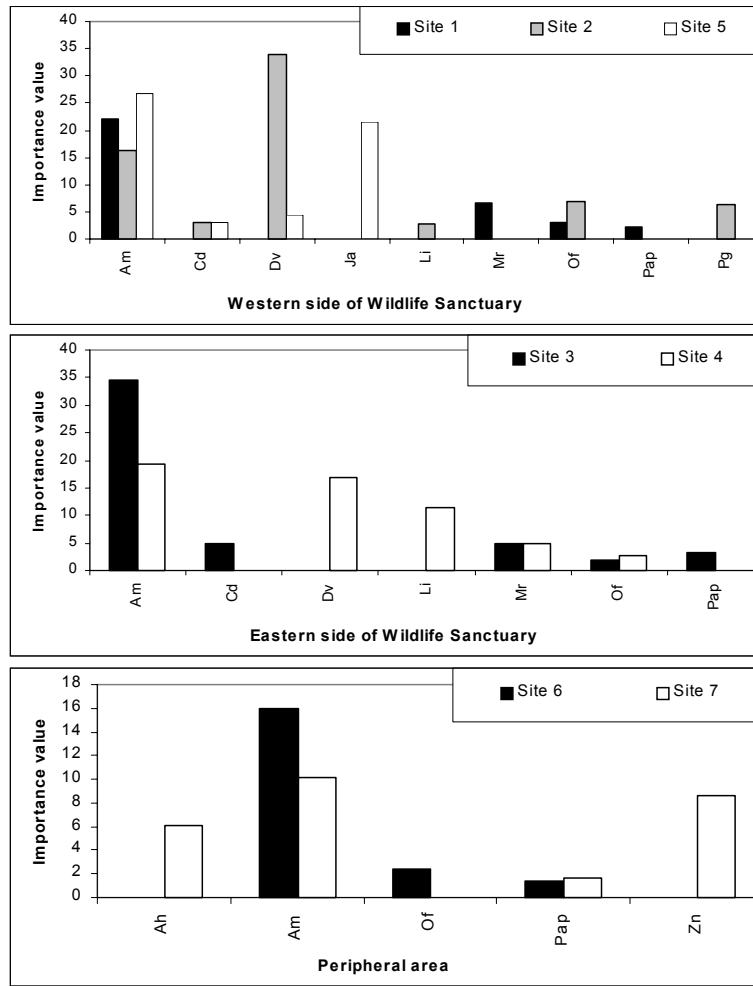
Cymbopogon jwarancusa and *Cynodon dactylon* was quite reasonable in most of the study sites. *Imperata cylindrica* and *Cynodon dactylon* dominated single vegetation study site but in the periphery of the main core area.

Acacia modesta was the single species among shrubs / trees which was recorded frequently in all study sites. Useful species like *Dodonaea viscosa*, *Capparis deciduas*, *Ziziphus nummularia*, *Justicia adhatoda* and *Maytenus royleanus* were frequent at very few areas; therefore, there is a need to improve their vegetation status. Among small shrub or herbs *Lespedeza floribunda*, *Pupalia lappacea*, *Opuntia monacantha* and *Diclyptera bupleuroides* were recorded in frequent number.

CONCLUSIONS

Chrysopogon serrulatus completely dominated all the sites of study within the core area as well as in the periphery. Habitat of Punjab urial is extremely rich in many palatable grass species and some valuable dicots. In spite of such an excellent habitat, urial population constantly remained endangered due to hunting and habitat destruction by wood/forage cutting. Illegal grazing is also one of the major causes of habitat disturbance; hence, indirectly affecting the urial population. One of the major drawbacks for urial is the drought seasons when water availability is restricted to few areas and this situation provides a great advantage to the hunters to shoot down thirsty animals around these water points. Another drastic damage to the urial population is the capturing of newly born fawns by the local people, particularly by the herdsmen, who often sell them to the people fond of keeping urial as pets, usually as a status symbol in the society. There is a crying need for the protection of urial population and its habitat to minimize the losses, which this valuable and endangered species is facing and ultimately helping in the increase in its population to a considerable amount.

Fig. 4. Importance value of shrub/tree species recorded in Chhumbi-Surla Wildlife Sanctuary



Ah (*Acacia hydasypica*), Am (*Acacia modesta*), Cd (*Capparis decidua*), Dv (*Dodonaea viscosa*), Ja (*Justicia adhatoda*), Li (*Lantana indica*), Mr (*Maytenus royleanus*), Of (*Olea ferruginea*), Pap (*Periploca aphylla*), Pg (*Prosopis glandulosa*), Zn (*Ziziphus nummularia*)

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