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Habitat Preference of Black Francolin (*Francolinus francolinus*) in Lal Suhanra National Park, Pakistan*

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Abstract.- Study was conducted on habitat preferred by the black francolin in Lal Suhanra National Park. A minimum of seventy plant species were identified for the stands preferring black francolin in their habitat, which included 12 trees, 11shrubs, 3 under shrubs, 21 herbs and 23 grasses. For roosting species exploited moderate sized plants like, *Ziziphus* sp (32.15%), *Accacia* sp (31.30%), *Tamrix* sp (23.18%), were more frequently exploited for roosting. Nesting was associated with minimum of 16 pant of which *Saccharum sp.*, *Tamrix* sp., *Typha angustata.*, *Phragmite karka*, *Panicum* sp., *Lasiurus* sp., *Aristida* sp., *Cenchrus* sp. were more preferred The francolin were distributed in significantly higher densities ($t = 2.25$, $df = 18$, $p = 0.03$) in the irrigated forest plantations (12.39±1.11 birds per km²) as compared to the tropical thorn forests (4.26±0.22 birds per km²). The tree cover has an almost linear increase with the increase in density of the black francolin (adjusted regression value = 0.970, $y = - 8.27 + 2.64x$), shrub cover (adjusted regression value = 0.964, $y = - 9.94 + 3.90x$), herb cover (adjusted regression value = 0.951, $y = - 3.94 + 4.90x$), and grass cover (adjusted regression value = 0.974, $y = - 6.61 + 6.18x$) has a curvilinear, while undershrubs (adjusted regression value = 0.810, $y = 1.245 + 9.33x$) has an almost linear regression with the population densities of the black francolin.

Key Words: Black francolin, preferred habitat**,** plant species, roosting, nesting.

INTRODUCTION

The black francolin (Francolinus francolinus) is globally a species of least concern based on its current population estimates (IUCN, 2007). The population of the species is declining due to excessive predation, hunting, poaching and loss of food due to habitat destruction (Roberts, 1991; Heidari *et al.*, 2009). This species of Galliformes is least studied so far by the biologist as compared with other species of the same Order (Khan, 2010). Habitat destruction, indiscriminate hunting and different pesticides used in agriculture practices are the most crucial factors threatening the populations of this species (Behbash *et al*., 2010). The black francolins lives in thicker vegetative cover, but come to cultivated crops and grassland to feed, chiefly in the morning and the late afternoon (Craft, 1966; Roberts, 1991; Khan and Mian, 2011). The species is resident in the Lal Suhanra National Park where it successfully breeds (Roberts, 1991). The species rests and roosts on ground in the thick cover of tall grasses, though often sits up on the branches of trees for calling (Bump and Bump, 1964; Ali and Ripley, 1983; Roberts, 1991; Khan, 2010). The birds may rest in open sun on sandy ridges with one or both wings expended (Hume and Oats, 1880) especially during winter. The bird largely runs for an escape ahead of the hunter or predator, breaking cover with a loud whirl of wings. The species takes short, low, swift and strong flight with rapid beats of its wing, punctuated with glides (Ali and Ripley, 1969; Roberts, 1991) but such flights remain last option for fleeing danger (Khan, 2010).

The nest of the species is a shallow depression produced through a scrap in the ground (Hume and Oats, 1880; Bump and Bump, 1964; Roberts, 1991). The nests, placed on ground in dense vegetation, are though hard to detect yet are exposed predation by mammals and reptile (Khan, 2010). The present study presents results on the plant preferred by the black francolins under the conditions of Lal Suhanra National Park (Pakistan).

MATERIALS AND METHODS

All of the 6 stands, having francolin populations, were sampled for the vegetative habitat during different seasons. A line intercept method was adopted in the present studies of vegetative

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analysis of the habitat, following a modified version of the method, used for communities having two or more distinct strata (Gaston, 1980).

In each stand 50 m long line transects (9–10 per stand) were randomly selected. The length of an individual plant, touching or passing through the imaginary transect line, was recorded, along with the species identification. The length of the transect line covered by each plants was divided by the transect length (50 m), and was considered as the absolute cover occupied by an individual plants. The cover occupied by each plant species was calculated by appropriate summing of the individual absolute covers of all the plants of that species. This data was also used to calculate the herb, shrub, tree and total vegetation cover in each stand falling under the random transect. The frequency of each plant was calculated as follows,

$$\text{Cover (\%)} = \frac{\text{Total intercept length of a species}}{\text{Total transect length}} \times 100$$

$$\text{Frequency (\%)} = \frac{\text{No. of quadrates in which species occurred}}{\text{Total No. of quadrates sampled}} \times 100$$

The stands randomly selected for studies having population of black francolin were extensively surveyed for the presence of different plant species which was identified following Nasir and Ali (1972). The location of the birds roosting on plant species was recorded directly in the field. The nests were located and the plant species present around the nest was recorded. The curvilinear regression analysis was undertaken for the study of association of the vegetative cover with the population density of the francolin species, using computer based program Minitab 15 (Khan, 2010).

The population density was studied using fixed strip transect sampling technique (Buranham *et al*., 1980; Krebs, 1989; Javed and Kaul, 2000). Each stand was sampled in the morning and evening for two consecutive days, during different calendar months. For each sampling the author accompanied by 2 – 3 field workers, experienced with francolin in the area, walked at a moderate speed (2-3 km / hour) taking at normal patch, along the predetermined 2.5 km long permanent transect line established in each stand, to count the number of individuals of francolins species sighted or flushed on both sides of the walking line. The counts were recorded directly by the senior author of the present studies.

Study area

The present study on the habitat preference by the black francolin was undertaken inside the Lal Suhanra National Park (LSNP: 29° 24' N - 71° 01' E) located at an altitude of 110-125 m above sea level in the northwestern part of the Cholistan Desert during 2000 - 2004. LSNP was declared as a national park in 1972, to separate some 314 km² of the Cholistan Desert to allow the normal desert ecosystem to develop and to afford protection and conservation to wild desert fauna and flora (Khan, 2010). The area has been maintained as a Reserve Forest since 1950 when checks on wood cutting were maintained along with some afforestation efforts along the canal by the irrigation department. The limits of the National Park were extended in 1984 to add another 202 km² (approx.) into the park, making a total of some 516 km², being presently maintained under the LSNP administration and protection (Mian and Ghani, 2007).

The geomorphology of the area varies between fairly flat and gentle to steep sand dunes. The area has a gradual natural slope from north to south. The major part of the area (442 km², 86% LSNP) is interspersed with sand dunes of varying heights (≤ 15m) and sizes (≤ 40 ha) (Mian and Ghani, 2007; Khan and Mian, 2012).

The area has a hot and arid climate resulting in general sub-tropical conditions. The study tracts are characterized by low and sporadic rainfall, associated with low relative humidity and high temperatures, and hence a high rate of surface evaporation (Rao *et al.*, 1989). Strong summer winds, running in the southeast direction, often resulted in sand storms, causing shifting of sand dunes and a higher level of wind erosion. Comparatively light breeze running in the northeast direction is characteristics of winter (Khan, 2010).

The area experiences a wide annual and monthly variation in temperature and rainfall. The available records on temperature variation at

Bahawalpur (main town located close and at similar altitude to LSNP) suggest that the minimum average temperature was experienced during December (3.5°C), whereas the maximum average monthly summer temperature was recorded during June (46.7 °C). However, the minimum temperature may remain below freezing point for some nights during the winter, whereas the maximum mid-day temperature may rise above 50°C for some of the summer days. Annual and seasonal variations in rainfall directly affect the wild vegetation and subsequently the animal populations.

RESULTS

A total of 70 plant species were recorded in the six stands having black francolin population. Twenty six plants species were present in all the six stands, while 5 were present in 5 stands, 8 in 4 stands, 28 species in 3 stands, 2 in 2 stands and 1 was recorded in only one stand (Table I).

The black francolin was distributed in stands, having an abundance of low shrubs and tall grasses. At least seventy plant species in their habitat confirms that this species like the habitat having a tall trees like (*Eucalyptus citriodora, Dalbergia sissco, Acacia nilotica, A. jacquemontii, Azadirachta indica, Ziziphus mauritiane, Z. jujube*) tall shrubs (*Prosopis spicigera, P. juliflora, Salvadora oleoides, Tamrix dioica, T. aphylla*) small shrubs (*Calligonum polygonoides, Calotropis procera, Capparis deciduas, Launea resedifolia, Haloxylon salicornicum, H. recurvum, Leptadenia pyrotechnica, Salsola foetida*) under-shrubs (*Aerua javanica, A. persica, Alhagi maurorum*) herbs (*Citrullus colocynthis, Corchorus olitorius, Euphorbia prostrate, Farsetia jacquemontii, Heliotropium strigosum*) and grasses and sedges (*Aristida hystricula, A. mutabilis, Anticharis linearis, Lasiurus hirsutus, Cenchrus* sp., *Cymbopogon jwarancusa, Cyperus triceps, Eleusine flagellifera, E. findica, Lasiurus sindicus, Sporobolus* sp., *Panicum atrosanguineum, P. psilopidum, P. antidotale, Pennisetum orientale*).

The francolin populations are distributed in two vegetation types, *viz.*, the sub-tropical thorn forests and the irrigated forest plantation (Table I). The direct supply of the irrigation canal water in the study stands was limited in the sub-tropical thorn forest where the vegetative cover remained low (8–14%), though it seems that there was some degree of stabilization of the sand dunes. The irrigated forest plantation received the perrineal supply of canal irrigation and held a higher vegetative cover (40–46%), but also had a number of invasive or introduced species *i.e., Eucalyptus citriodora, Dalbergia sissoo, Ficus religiosa, F. bengalensis, Typha angustata.* No black francolin population was present in sand dunes or swamp forest vegetation type. The average population density 13.28±2.25 birds per Km² recorded in the stand having plant cover 40.51%, 12.68±2.32 birds per Km² in 40.92%, 11.22±2.11 birds per Km² in 45%, 4.95±1.03 birds per Km² in 13.75%, 4.84±1.02 birds per Km² in 13.32% and 3.44±0.88 birds per Km² in the stand having plant cover 11.33%.

Roosting

Black francolin was recorded roosting on at least ten species of plants (Table II). Major part of roosting occurs in three comparatively low sized tree species, *Ziziphus* sp (32%), *Accacia* sp (31.30%), and *Tamrix* sp (23%), whereas 7 species were rarely exploited (≤ 5%) for roosting (Table II). This is contradictory to the claims of Bump and Bump (1964), Ali and Ripley (1983) and Roberts (1991) that suggesting this species does not roost on branches of plants, not even for calling.

Black francolin is adapted to thicker cover may explain preferential habitat selection (Roberts, 1991). The black francolin were distributed in significantly higher densities ($t = 2.25$, $df = 18$, $p = 0.03$) in the irrigated forest plantations (12.39±1.11 birds per km²) as compared to the tropical thorn forests (4.26±0.22 birds per km²). General observation indicated that even in the tropical thorn forests the black francolin remained restricted to the parts of the stands near to the irrigated forest plantation.

The curvilinear regression carried out under the present study suggested that total plant cover as the characteristic that has the greatest influence of the population of the black francolin (adjusted regression value = 0.989, $y = -11.10 + 1.46x$, Fig.1A). The curvilinear regression analysis on the variation population densities of the francolin

Table I.- Plant species composition recorded in the different stand having Black Francolin population in LSNP.

	Stand ≠1	Stand ≠2	Stand ≠3	Stand ≠ 4	Stand ≠ 5	Stand ≠ 6
	Irrigated forest			Tropical thorn forest		
Black francolin density/km²	**13.28**	**12.68**	**11.22**	**4.95**	**4.84**	**3.44**
Total plant cover (%)	**40.51**	**40.92**	**45**	**13.75**	**13.32**	**11.73**
Eucalyptus citriodora	+	+	+	-	-	-
Dalbergia sissco	+	+	+	-	-	-
Acacia nilotica	+	+	+	+	+	+
Acacia jacquemontii	+	+	+	+	+	+
Azadirachta indica	+	+	+	-	-	-
Prosopis spicigera	+	+	+	+	+	+
Prosopis juliflora	+	+	+	+	+	+
Ziziphus mauritiane	+	+	+	+	+	+
Ziziphus jujube	+	+	+	+	+	+
Salvadora oleoides	+	+	+	+	+	+
Tamrix dioica	+	+	+	+	+	+
Tamrix aphylla	+	+	+	+	+	+
Abutilon muticum	+	+	+	+	+	+
Typha angustata	+	+	+	-	-	-
Phragmite karka	+	+	+	-	-	-
Launea resedifolia	+	+	+	+	+	+
Calligonum polygonoides	+	+	+	+	+	+
Calotropis procera	+	+	+			
Capparis deciduas	+	+	+	+	+	+
Haloxylon salicornicum	-	-	-	+	-	+
Haloxylon recurvum	-	-	-	+	-	+
Leptadenia pyrotechnica	+	+	+	+	+	+
Salsola foetida	+	+	+	-	-	-
Aerua javanica	+	+	+	+	-	+
Aerua persica	+	+	+	-	-	-
Alhagi maurorum	+	+	+	+	+	+
Saccharum munja	+	+	+	+	+	+
Saccharum spontanium	+	+	+	+	+	+
Citrullus colocynthis	+	+	+	-	-	-
Indigofera oblongifolia	+	+	+	-	-	-
Indigofera sessiliflora	+	+	+	-	-	-
Chenopodium murale	+	+	+	-	-	-
Chenopodium album	+	+	+	-	-	-
Medicago satius	+	+	+	-	-	-
Pennisetum typhoides	+	+	+	-	-	-
Solanum nigrum	+	+	+	-	-	-
Cucumis prophearur	+	+	+	-	-	-
Oligochaeta ramose	+	+	+	-	-	-
Datura alba	+	-	-	+	+	+
Cucumis sp.	+	+	+	-	-	-
Corchorus olitorius	+		+	-	-	+
Lathyrus spp.	+	+	+	-	-	-
Euphorbia prostrata	+	+	+	-	-	-
Farsetia jacquemontii	+	-	-	-	-	-
Oligochaeata ramosa	+	+	+	-	-	-
Heliotropium strigosum	+	+	+	-	-	-
Aristida hystricula	+	+	+	+	+	+
Aristida mutabilis	+	+	+	+	+	+

Continued

	Stand ≠1	Stand ≠2	Stand ≠3	Stand ≠ 4	Stand ≠ 5	Stand ≠ 6
	Irrigated forest			Tropical thorn forest		
Black francolin density/km²	**13.28**	**12.68**	**11.22**	**4.95**	**4.84**	**3.44**
Total plant cover (%)	**40.51**	**40.92**	**45**	**13.75**	**13.32**	**11.73**
Anticharis linearis	+	+	+		-	-
Lasiurus hirsutus	+	+	+	+	+	+
Cenchrus biflorus	+	+	+			-
Cenchrus pennisetiformis	+	+		+	+	+
Cenchrus granularis	+	-	-	+	+	+
Cenchrus ciliaris	+		-	+	+	+
Cymbopogon jwarancusa	+	+	+			-
Cyperus triceps	+	+	+	+	+	-
Limeum indicum	+	+	+		-	-
Eleusine flagellifera	+	+	+	+	+	+
Eleusine findica	+	+	+	+	+	+
Lasiurus sindicus	+	+	+	+	+	+
Cyperis rotundus	+	+		+	+	+
Sporobolus spp.	+	+	+	-	-	
Suaada fruticosa	+	+	+	+	+	+
Panicum atrosanguineum	+	+	+		+	
Panicum psilopidum	+	+	+	+	+	+
Chrysopogon serrulatus	+	+	+	+		
Panicum antidotale	+	+	+	+	+	+
Pennisetum orientale	+	+	+	-	+	-
Cynodon dactylon	+	+	-	-	-	-
Dipterygium glaucum	+	-	-	+	+	+

Table II.- Frequency of roosting of black francolin on different plant species in LSNP.

Name of plants	Stand ≠ 1	Stand ≠ 2	Stand ≠ 3	Stand ≠ 4	Stand ≠ 5	Stand ≠ 6	Overall	%
Ziziphus sp.	48	51	45	17	15	14	190	32.15
Acacia sp.	51	41	55	14	11	13	185	31.30
Tamrix sp.	30	28	39	12	11	17	137	23.18
Salvadora oleoides	-	-	-	10	12	9	31	5.25
Prosopis sp.	7	3	-	-	1	2	13	2.20
Azadirachta indica	1	5	2				8	1.35
Haloxylon sp.	-	-	-	3	2	3	8	1.35
Capparis decidua	-	-	-	4	1	2	7	1.18
Abutilon muticum	-	-	-	2	1	3	6	1.02
Launea resedifolia	-	-	-	-	2	4	6	1.02

species by different layers of the vegetation curve suggests a similar trend. The tree cover has an almost linear increase with the increase in density of the black francolin (adjusted regression value = 0.970, y = -8.27 + 2.64x, Fig.1B). Shrub cover (adjusted regression value = 0.964, y = -9.94 + 3.90x, Fig.1C), herb cover (adjusted regression value = 0.951, y = - 3.94 + 4.90x, Fig.1D), and grass cover (adjusted regression value = 0.974, y = -6.61 + 6.18x, Fig. 1E) were curvilinear, while undershrubs (adjusted regression value = 0.810, y = 1.245 + 9.33x, Fig.1F) has an almost linear regression with the population densities of the black francolin.

Nesting

The data collected on 37 nests revealed that the nest was surrounded by different clusters of the plants. A minimum of 16 plant species were associated with nesting sites of black francolin

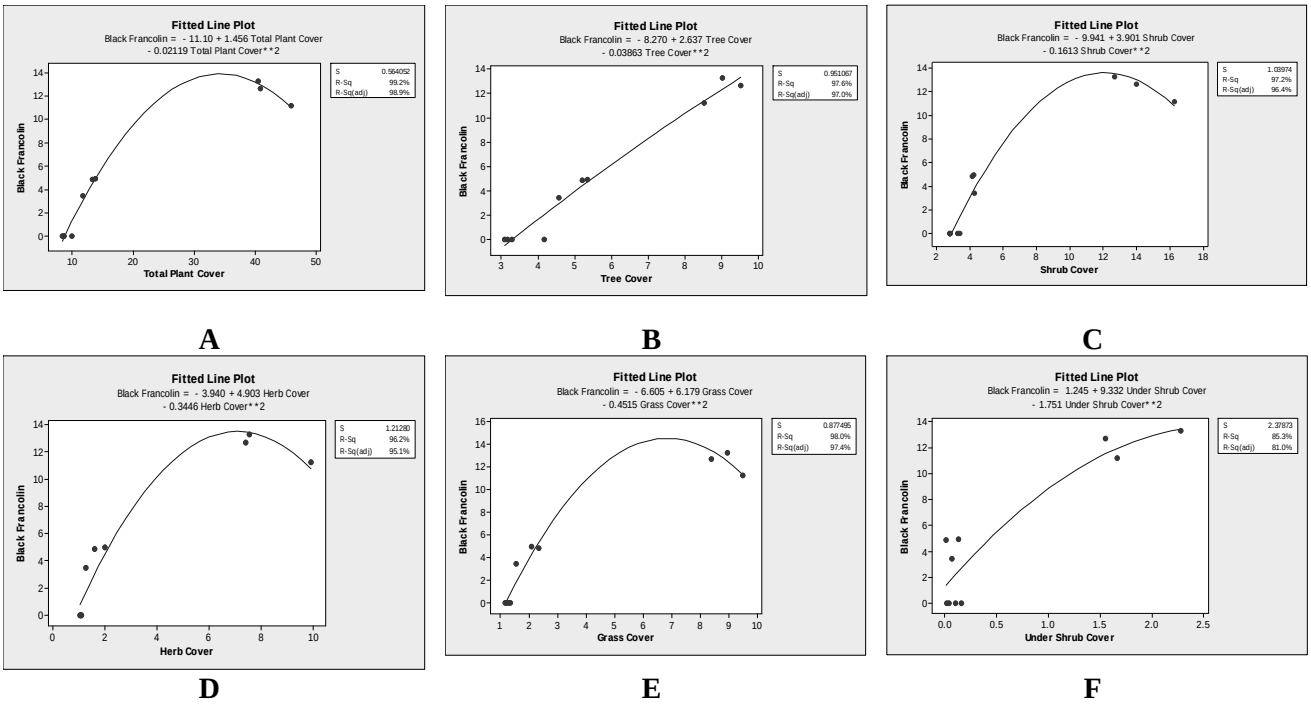

Fig. 1. Relationship of black francolin population with total plant cover (A), tree cover (B), shrub cover (C), herb cover (D), grass cover (E) and undershrub cover (F) in the study sites.

Table III.- Relative frequencies (%) of black francolin nest recorded in association to different plant species in LSNP.

Plants species	Frequency
Saccharum sp.	11.49
Tamrix sp.	8.93
Typha angustata	8.93
Phragmite karka	8.93
Panicum sp.	8.93
Lasiurus sp.	8.08
Aristida sp.	8.08
Cenchrus sp.	6.80
Pennisetum sp.	5.31
Azadirachta indica	5.31
Calligonum polygonoides	5.11
Prosopis sp.	5.11
Ziziphus sp.	3.82
Salvadora oleoides	1.70
Launea resedifolia	1.70
Haloxylon sp.	1.27

under the condition of LSNP (Table III). Higher frequencies of nests were located close to 8 plant species (*Saccharum* sp., *Tamrix* sp., *Typha angustata*, *Phragmite karka*, *Panicum* sp. *Lasiurus* sp., *Aristida* sp., *Cenchrus* sp.)

Black francolin nest were recorded under 6 plant species. A large number (15, 40.1%) of nests were found under small sized *Tamrix* sp., whereas a generally decreasing the number of nests were recorded under *Prosopis* sp (9, 24.3%), *Ziziphus* sp. (6, 16.2%), *Salvadora oleoides* (4, 10.8%) and *Haloxylon* sp (3, 8.1%). No previous study is on hand on such associations of nests. Small sized trees provide cover to nest from solar radiation, while the shrubs and grasses provide camouflage for the nests.

DISCUSSION

Our general observation in LSNP reveals that during summer the francolin species prefer to roost in the lower branches having some shade, while in winter it exploited upper branches to get warmth of sun. Similarly on rainy days they used the lowest possible braches to protect themselves from rain showers. The present data on the vegetative cover is not sufficient to examine the effect of a continuous variable, as the cover in the stands in the present study falls on two sides with a wide gap in the

middle. The vegetative covers usually have a curvilinear regression with the animal population, with the central optima decided through the potentials of the species (Behbash *et al*., 2010). Increasing vegetative cover provides increased thermal problems to some extent (Trautman, 1982; Gatti *et al.,* 1989; Perkins *et al*., 1997; Gabbert *et a*l., 1999; Novoa *et al*., 2006) but increases mammals/reptiles predation. The decreased cover increases avian predation, and lower the camouflaging values and thermal protection of the habitat (Subramanian *et al*., 2002)

Some plant species including trees, shrubs, herbs and grasses have a great importance for the shelter, roosting and nesting purposes such as *Eucalyptus citriodora, Dalbergia sissco, Acacia nilotica, Acacia jacquemontii, Azadirachta indica, Ziziphus mauritiane, Ziziphus jujube, Prosopis spicigera, Prosopis juliflora, Salvadora oleoides, Tamrix dioica, Tamrix aphylla, Calligonum polygonoides, Calotropis procera, Capparis deciduas, Launea resedifolia, Haloxylon salicornicum, Haloxylon recurvum, Leptadenia pyrotechnica, Salsola foetida, Aerua javanica, Aerua persica, Alhagi maurorum, Citrullus colocynthis, Corchorus olitorius, Euphorbia prostrate, Farsetia jacquemontii, Heliotropium strigosum, Aristida hystricula, Aristida mutabilis, Anticharis linearis, Lasiurus hirsutus, Cenchrus spp., Cymbopogon jwarancusa, Cyperus triceps, Eleusine flagellifera, Eleusine findica, Lasiurus sindicus, Sporobolus* sp., *Panicum atrosanguineum, Panicum psilopidum, Panicum antidotale and Pennisetum orientale*. Mahmood *et al.* (2010) showed almost the same results in Lehri National Park and found *Acacia modesta, Acacia nilotica, Ziziphus spinachristi, Eucalyptus camaldulensis, Dalbergia sissoo, Radia tetraspermia, Adhatoda vesica, Ostostegia limbata, Dodonia viscose, Desmotachya bipinata, Cynodon dactylon, Cinchrus ciliarus, Calotropis procera,* and *Triticum aestivum* as major plant species for the francolins habitat. Plant species like *Aeloropus lagopoides, Alhaji camelorum, Atriplex leucoclada, Carthamous oxyacantha, Citrullus colycinthus, Convolvulus* sp., *Cressa cretica, Cynodon dactylon, Desmosttachya bippinata, Halostachys persica, Haloxylon persicum, Hordium* sp., *Medicago* sp., *Phragmites australis, Prosopis stephaniana, Rumex* sp., *Salsola* sp., *Seiditzia* sp., *Stuvvle* sp., *Suaeda* sp., *Surghum* sp., *Tamrix* sp., and *Trictum aestivum* were the preferred habitat for black francolin for shelter and food purposes in Sistan Plain in Iran (Heidari *et al.,* 2009)

The black francolin has been reported to occur in the scrub habitats, having plenty of low shrubs and tall grasses (Roberts, 1991). The presence of a higher population of black francolin in the thick growth of shrubs and tall grasses around wetland (Khan, 1989), or xerophytic vegetation in Sri Lanka (Wijeyamohan *et al*., 2003) is consistent with such habitat selection by this species. The male black francolin prefers low plant cover in order to attract the attentions of females (Behbash *et al*., 2010). The present study showed that vegetative covers between 40 – 46 percent were the most suitable for the species whereas low vegetative cover 8 – 14 percent were least suitable. For shelter, roosting and nesting purposes, different species of trees, shrubs and herbs with high vegetative cover are important for the survival of francolin species (Mahmood *et al.,* 2010). Crown cover and height of vegetation support the francolin species for the purpose of hidden from the predators and the availability of food item in term of both, insects and seeds (Heidari *et al.,* 2009)

Results of the present studies showed that maximum number (13.28±2.25 birds per Km²) of black francolin was recorded in the stand having plant cover 40.51%, where as minimum numbers (3.44±0.88 birds per Km²) was recorded in the stand having plant cover 11.33%. The stands having high plant cover 40.92% and 45%, having population density 12.68±2.32 birds per Km² and 11.22±2.11 birds per Km² which can be ascribed that increased in plant cover increased some sort of problems need to study for the present study area, where as previous studies in different other areas described it as thermal problems (Trautman, 1982; Gatti *et al*., 1989; Perkins *et al*., 1997; Gabbert *et a*l., 1999; Novoa *et al*., 2006)

The presence of the black francolin in/or around irrigated plantations supported our hypothesis that this species extended its range of distribution into the areas in LSNP after the introduction of the canal irrigation and consequently

the development of irrigated forests. Irrigated forest plantations along with natural vegetation in various sub-mountainous tracts are the potential habitat for francolins (Mann and Chaudhry, 2000), and black francolins sometimes exploits branches of small bushes (Khan, 1989).

The regression curve suggests a cover optima of 30 – 40% for the black francolin, such type of curvilinear control of the vegetation cover has been previously indicated for the houbara bustard (*Chlamydotis undulate macqueeni*) (Mian, 1985). 15-44% plant cover was recorded in the preferred habitat of black francolin during summer in Iran (Behbash *et al*., 2010). The reduction of vegetation cover plays the most important role in decreasing the population size due to decrease of plant cover (Khan, 2010) and range distribution of the black francolin species (Heidari *et al.*, 2009).

No previous study is known in which the vegetative cover was the identified as the environmental determinant of the population of the black francolin. More refined conservation studies are required having a continuous range of vegetative cover to determine the optimal requirement for this species. The role of vegetative cover has been indicated in different studies by suggesting different population densities of the black (Khan, 1989) and the grey (Ullah, 1991) Francolins, presence of higher population of redwing francolin (*Francolinus levaillantii*) in unburnt and ungrazed tract (Hupp, 1980). Higher population of grey wing francolin (*Francolinus africanus*) in grazed tract (Janson *et al.*, 1999) and shrub cover, the main determinant of the population of the grey jungle fowl (*Gallus sonneratii*) (Sathyanarayana, 2007).

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