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Food of Black Francolin (*Francolinus francolinus henrici*) in Lal Suhanra National Park, Pakistan*

Waseem Ahmad Khan and Afsar Mian**
Department of Zoology, PMAS Arid Agriculture University, Rawalpindi, Pakistan

Abstract.- Keeping to the persistent concern of wildlife enthusiasts regarding decline of the Black Francolin (*Francolinus francolinus*) and general absence of quantified studies on feeding biology, the present attempt was designed to study the relative dependence of this Francolin on different animal and plant species, seasonal variation in food intake and the association of grit with different broad type of food. For the purpose 28 crop contents (spring = 8, summer = 7, autumn = 6, winter = 7) were collected from the birds hunted during 1998 from the Lal Suhanra National Park, Bahawalpur, Punjab (Pakistan) through the courtesy of local hunters. The study suggested that on the average the species consumed seeds (43.33±7.30%) and leaves (8.12±1.31%) of 33 plant and 11 animal texa (mainly insects and earthworm (32.94±5.43%). The species composition of contents varied between different seasons, however, animals and leaves were consumed in higher quantities during summer and spring and seeds in autumn and winter. Grit was positively associated with seeds ($R^2 = 0.8318$) and negatively with animals ($R^2 = - 0.8738$) and leaves ($R^2 = - 0.539$).

Key words: Black Francolin, *Francolinus francolinus henrici*, food items, seasonal variation, animals, leaves, girt.

INTRODUCTION

South Persian Black Francolin (*Francolinus francolinus henrici*: Order Galliformes, Family Phasianidae) is widely distributed on the Indus Plains and associated hills in Pakistan up to 1,550 m above sea level (asl) (Ali and Ripley, 1987; Roberts, 1991). The global population of this species is stable (del Hoyo *et al*., 1994; IUCN, 2007), yet the wildlife enthusiasts in Pakistan frequently express their concern over decline in its population (Roberts, 1991). The species is considered as friend of farmers consuming insect pests, their eggs and larvae (Qureshi, 1972), and impacts human cultural and social life of the region (Lum, 1986; Javed, 1999). A population of the species is present in the Lal Suhanra National Park (Khan, 2010) occurring in a reasonably protected habitat.

The food of the Black Francolin is known from different accounts on species biology, developed through available casual field observations (Ali and Ripley, 1969; Cramp and Simmons, 1980; Roberts, 1991). The species had been regarded as omnivore, consuming a variety of plants (wild and cultivated) and animals (Faruqi *et al*., 1960; Bump and Bump, 1964; Dement`ev and Gladkov, 1967; Ali and Ripley, 1969; Roberts, 1991; Chaudhry and Bhatti, 1992). There is considerable variation between the lists of food species appearing in different reports (Faruqi *et al*., 1960; Bump and Bump, 1964; Dement`ev and Gladkov, 1967), each focusing on a different geographic area. Few studies on quantified analysis of food and feeding preference of this Francolin species have been published. Dement`ev and Gladkov (1967), depending on analysis of 140 crop contents collected from India, suggested that the species had a higher reliance on animals during summer and on plants during winter. The analysis of 10 crop contents, collected from Faisalabad (central Punjab, Pakistan), revealed that 28% of the food of the species came from animals (Khan, 1989). Grit frequently appeared in the crop contents (Dement`ev and Gladkov, 1967; Ali and Ripley, 1969; Roberts, 1991; Chaudhry and Bhatti, 1992; Khan, 2010).

The present study was designed to examine the hypothesis that the Black Francolin maintained its omnivorous nature under the conditions of irrigated plantation in the Lal Suhanra National Park, Pakistan. Further, it was hypothesized that food of the species in an area represented a compromise between the physiological requirements of the species and availability of the food species in

* Part of Ph. D. thesis of senior author

** Corresponding author: afsarmianpk@yahoo.com

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the environment. The specific objectives of this study were to examine (1) relative dependence on animal and plant matter (2) relative consumption of different food species and/or their parts (3) seasonal variation in food, and (4) association of grit with different major categories of the food.

MATERIALS AND METHODS

Study area

The present study was undertaken during 1998 – 2000 in the Lal Suhanra National Park (LSNP: 29° 12' - 29° 28' NL, 71° 48' - 72° 08' E, altitude = 110 – 125 m asl), located in the northwestern part of the Cholistan desert (southeastern Punjab, Pakistan; representing the northwestern Thar Desert). The area was characterized by low and sporadic rainfall, associated with low relative humidity, high temperature, and high surface evaporation. Summer is harsh whereas winter is milder. Summer monsoon precipitation (July – August) is more reliable and frequent, and hence the vegetation mainly flowers during autumn, though some bloomed in spring. The Black Francolin is present in the irrigated plantation and associated tracts, of tropical thorn forests. A minimum of 105 plants species (trees = 15, shrubs = 9, under shrubs = 7, herbs and grasses = 74; Khan, 2010) and a variety of animals, including insects and earthworms are present. A dirt tract passed through the Francolin habitat and is used to carry cultivated grains (wheat, maize, and mustard) to the market.

Food contents

Twenty-eight crops were collected from freshly killed Black Francolin obtained through local hunters from the LSNP and adjacent areas during spring (February – April; n = 8), summer (May – July; n = 7), autumn (August – October; n = 6), and winter (November – January; n = 7). Each crop was weighed in the field (Sartorius, top loading, minimum count 1 gm), legated on two ends with a thread and packed separately in plastic bags, having 7% commercial grade formalin, and taken to the laboratory where it was dissected and its contents were removed. The empty crop was weighed (Sartorius) and the difference between fresh and emptied crop weights was taken as crop content weight.

The food content from each crop was washed under running water to remove formalin and placed in a Petri dish. The identifiable pieces were separated and identified to the lowest possible taxonomic category, following Nasir and Ali (1972) for plants and Richards and Davies (1977) and Yousaf and Siddiqui (1989) for insects with naked eyes or with the help of a hand lens or a dissecting microscope (10-20 X, Olympus, Japan) in selected cases. Some of the pieces could not be identified and were recorded as unidentified (plant or animal or general). The grit appearing in the contents was separated and weighed. The parts of each content representing different classes were weighed and expressed as percentiles of the total weight of the content.

Statistical analysis

The data on different classes of the food in each content were then appropriately pooled to calculate average and standard error of mean (SEM) of each food item in the total sample or different seasonal samples. Regression analyses of girt with seeds, leaves and animal matter were conducted (Sokal and Rolf, 2000).

RESULTS

General food

The average weight of the stomach contents under the present sample was calculated as 17.35±5.75 gm. The relative contribution of different items in the average crop content (Table I) revealed the presence of 45 species of plants (33) and animals (12). This was despite the fact that 12.0% of the organic contents remained unidentified as plants (3.3±1.5%), animals (5.1±1.2%), or general unidentified (3.6±1.1%). The plants contributed 51.4±6.3 %, and the animals' 32.9±5.4% of the average crop content. Grit constituted 11.9±2.1 % of the average weight of the contents. In the plant matter, seed (43.3±7.3%) were predominant, while leaves (8.1±1.3%) constituted a smaller part of the content.

Table I.- Relative consumption of different items of food species by Black Francolin in Lal Suhanra National Park (n = 28).

Food species	Seeds	Leaves	Total	Consistency (%), n
Plants	**43.3±7.3**	**8.1±1.3**	**51.4±6.3**	**100, 28**
Eleusine sp.	4.4±1.1	0.6±0.1	5.1±1.1	71.43, 20
Triticum aestivum	4.5±1.2	0.0±0.0	4.5±1.1	71.43, 20
Aristida sp.	3.3±1.1	0.0±0.0	3.3±1.1	67.86, 19
Medicago satva	2.5±0.1	0.8±0.1	3.3±0.1	67.86, 19
Cenchrus sp.	2.9±0.2	0.0±0.0	2.9±0.1	64.29, 18
Dactyloctenium spp.	3.0±0.2	0.0±0.0	3.0±0.2	50.00, 14
Lathyrus sp.	2.2±0.2	0.3±0.1	2.6±0.1	46.43, 13
Zea mays	1.4±0.2	0.0±0.0	1.4±0.2	46.42, 13
Capparis decidua	1.5±0.1	0.5±0.1	2.0±0.1	46.42, 13
Acacia sp.	2.3±0.2	0.0±0.0	2.3±0.2	42.86, 12
Pennisetum typhoides	2.4±0.2	0.0±0.0	2.4±0.2	42.86, 12
Arnebia sp.	1.5±0.1	0.0±0.0	1.5±0.1	39.29, 11
Cyperus rotundus	1.6±0.1	0.0±0.0	1.6±0.1	35.71, 10
Corchorus depressus	0.2±0.1	0.4±0.1	0.6±0.1	35.71, 10
Suaeda fruticosa	1.3±0.1	0.0±0.0	1.3±0.1	32.14, 9
Trifolium alexandrianum	0.6±0.2	0.5±0.1	1.2±0.1	28.57, 8
Prosopis juliflora	0.5±0.1	0.5±0.1	1.0±0.1	25.00, 7
Solanum surattense	0.8±0.2	0.1±0.1	0.9±0.2	25.00, 7
Indigofera sp.	0.0±0.0	0.3±0.1	0.3±0.1	21.43, 6
Eragrostis sp.	0.2±0.1	0.0±0.0	0.2±0.1	21.43, 6
Chenopodium murale	0.0±0.0	0.5±0.1	0.5±0.1	21.43, 6
Polygala sp.	0.5±0.1	0.0±0.0	0.5±0.1	17.86, 5
Chenopodium album	0.0±0.0	0.2±0.1	0.2±0.1	17.86, 5
Lasiurus sindicus	0.4±0.1	0.0±0.0	0.4±0.1	14.29, 4
Anticharis linearis	0.6±0.1	0.0±0.0	0.6±0.1	14.29, 4
Panicum sp.	0.2±0.1	0.0±0.0	0.2±0.1	14.29, 4
Solanum nigrum	0.0±0.0	0.1±0.1	0.1±0.1	14.29, 4
Launea resedifolia	0.0±0.0	0.2±0.1	0.2±0.1	10.71, 3
Fagonia cretica	0.8±0.1	0.0±0.0	0.8±0.1	10.71, 3
Leptadenia sp.	0.3±0.1	0.0±0.0	0.3±0.1	10.71, 3
Fagonia sp.	0.1±0.1	0.0±0.0	0.1±0.1	10.71, 3
Atylosia sp.	0.0±0.0	0.3±0.1	0.3±0.1	10.71, 3
Limeum indicum	0.0±0.0	0.1±0.1	0.1±0.1	7.14, 2
Unidentified Plants	2.2±0.2	1.1±0.2	3.3±0.2	100, 28
Animals			**32.9±5.43**	**100, 28**
Neotermes sp.			4.8±1.1	89.29, 25
Homoptera			4.1±1.1	85.71, 24
Diptera			3.0±0.2	78.57, 22
Staphylinidae			2.9±1.1	71.43, 20
Hymenoptera			2.1±0.1	53.57, 15
Coleoptera			3.4±0.2	50.00, 14
Orthoptera			2.1±0.2	42.86, 12
Curculionidae			1.5±0.1	39.29, 11
Aeshnidae			1.0±0.1	21.43, 6
Lumbricus sp.			0.8±0.1	17.86, 5
Gryllidae			0.6±0.1	7.14, 2
Unidentified Animals			5.1±1.2	100, 28
Grit				
Unidentified Material			**11.9±2.1** **3.6±1.1**	**100, 28** **100, 28**

No species was heavily (> 5 %) represented as a food item in the average crop content, and a majority (20 = 17 plants and 3 animals) contributed less than 1% of the average contents. Some species, however, were very heavily represented in certain isolated crops. The values of constancy of appearance (Table I) of different food items (both plant and animal species) were relatively high. Two animal species (representing orders Isoptera and Homoptera) were placed in constancy class V (>80%), while 7 others (5 plant, 2 animal) in class IV (61–80 %) and 19 (16 plant, 3 animal) in class III (41–60 %). There was, however, a high correlation (r = 0.70) between the average contribution and constancy of appearance of different texa. Eighteen plant texa (*Triticum aestivum, Aristida* sp., *Cenchrus* sp., *Dactyloctenium* sp., *Zea mays, Acacia* sp., *Pennisetum typhoides, Arnebia* sp., *Cyperus rotundus, Suaeda fruticosa, Eragrostis* sp., *Polygala* sp., *Lasiurus sindicus, Anticharis linearis, Panicum* sp., *Fagonia cretica, Leptadenia* sp., *Fagonia* sp.) were represented by seeds only, and another 7 (*Indigofera* sp., *Chenopodium murale, C. album, Solanum nigrum, Launea resedifolia, Atylosia* sp., *Limeum indicum*) by leaves only, while 8 (*Elucine* sp., *Medicago satva, Lathyrus* sp., *Capparis deciduas, Corchorus depressus, Trifolium alexandrianum, Prosopis juliflora, Solanum surattense*) were represented by both seeds and leaves.

Seasonal variation

The analysis of the seasonal samples (Table II) revealed considerable variation in the composition of the average contents. Twelve (*Elucine* sp., *Triticum aestivum, Aristida* sp., *Medicago satva, Lathyrus* sp., *Cenchrus* sp., *Dactyloctenium* sp.,

Accacia sp., *Pennisetum typhoides*, *Cyperus rotundus*, *Zea mays*, *Capparis deciduas*) texa of plants and 8 (*Neotremes* sp., Homoptera, Staphylinidae, Diptera, Orthoptera, Coleoptera, Hymenoptera, Curculionidae) of animals were consumed in all the seasons, whereas the other texa appeared only in one or more seasonal samples. The relative consumption of all the texa was also different among seasonal samples. The plant part of the crop contents was represented by highest number of texa in spring (26), followed by summer (24) and winter (21), and the lowest number in autumn (18) samples. The Seeds were represented by 18 texa each in summer, autumn and winter, and by 15 in spring samples. Leaves were observed from the highest number of texa in the spring samples (14), followed by summer (11) and winter (7) and from only 3 texa in autumn samples. The animal part of the contents was represented by the highest number of texa in summer (13), followed by the spring (12), whereas autumn (8) and winter (8) samples had lower numbers of texa.

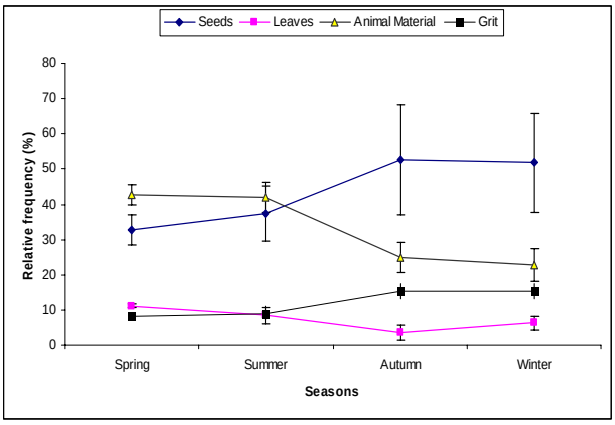

Fig. 1. Comparison of food material consumed by Black Francolin in different seasons in Lal Suhanra National Park.

The relative distribution of animal and plant part of the average crop content (Fig. 1) suggests that animals and plants were almost equally represented in spring ($t_{(37)} = 0.62$, $p > 0.05$) and summer ($t_{(34)} = 0.99$, $p > 0.05$) samples. However, the animal contents were significantly lower in autumn ($t_{(24)} = 3.15$, $p < 0.05$) and winter ($t_{(27)} = 2.05$, $p < 0.05$) samples compared with the plant contents. Amongst the vegetative components, the representation of leaves gradually decreased from spring (11.08 %) through summer (8.5 %) to autumn (3.6 %) and winter (6.3 %). The seeds contributed the higher proportion in autumn (52.6±15.7 %) and winter (51.8±14.0 %) samples, as compared with spring (32.6±4.2 %) and summer (37.2±7.9 %) samples.

Grit

Grit constituted an appreciable part of the stomach contents (overall average = 11.9±2.1 %) of all the seasonal samples, though it was represented in relatively higher proportion in autumn (15.3±2.1 %) and winter (15.1±2.1%) as compared with spring (8.0±1.7 %) and summer (9.0±2.1 %) samples. The grit exhibited a significant positive association with seeds ($Y = 0.4247 \times -6.94$, $R^2 = 0.8318$, $F = 128.57$, $p < 0.001$) and a significant negative association with leaves ($Y = - 1.0014 \times 18.913$, $R^2 = 0.539$, $F = 30.50$, $p < 0.001$) and animals ($Y = - 0.4007 \times 24.742$, $R^2 = 0.8738$, $F = 179.99$, $p < 0.001$) part of the content (Fig. 2).

DISCUSSION

The results of the present study revealed that the Black Francolin under the conditions of LSNP consumed a minimum of 33 plant and 12 animal texa. This indicated that the species has omnivorous character. A wide base of the Black Francolin food could be expected, as different previous reports have enlisted a different plants and animals species, as food of this species. (Faruqi *et al*., 1960; Bump and Bump, 1964; Chaudhry and Bhatti, 1992; Khan, 1989). Further sampling and refined identification of the unidentified material/species may further enlarge the list of food items. The present list was longer than those suggested previously, though this study was limited to a much smaller geographic area. A wider diversity in plant and insect species available in the habitat of this Francolin species in the LSNP due to protection (Mian and Ghani, 2006; Khan, 2010) and canal irrigation partly explained the consumption of a higher number of the food species by the Francolins. However, we could not find evidence of consumption of snails, lizards, snake (Cramp and Simmons, 1980) or arachnids

(Khalieghizadeh and Sehhatisabet, 2006) by the Black Francolin, as suggested previously.

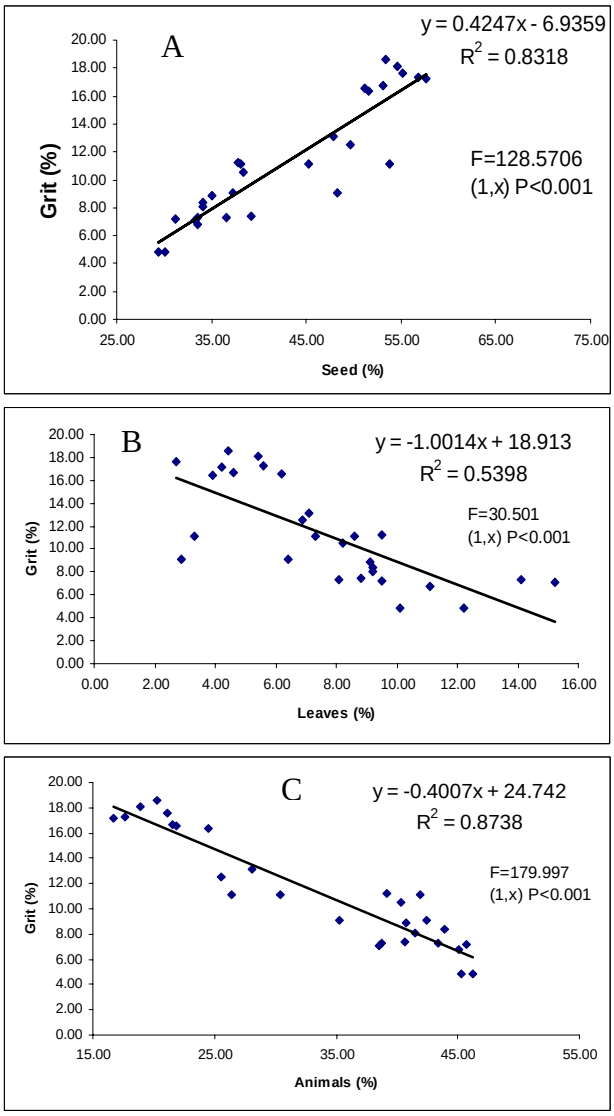

Fig. 2. Regression of the seeds A, leaves; B, and animal; C, part of the food with the grit in the stomach contents of the Black Francolin.

The diversity in the food species though appeared to attribute a food generalistic characteristic to the species, yet only 33 plant species could be identified from the crop content out of the 105 species available in the Black Francolin habitat in LSNP (Khan, 2010). The present results also revealed that the species did not have a very heavy reliance on a single food species (single species contribution in to the crop contents remain below 6 %). This is despite the fact that some of the food species presented high constancies (>80 % of the contents). A wider base of the food species adopted by this Francolin species is in the advantage of the species, ensuring its survival under all the odds. Under the effect of such food diversity, the species was able to amicably withstand the effects of severe drought, without seriously lowering its population, viz, especially under the mild drought (Khan, 2010).

The Black Francolin mainly depended upon picking up of the seeds (51.4 % of the identified food) from the ground, though insects picking (39 %) also had an important contribution. Leaves (9.6 %) were the least consumed item. This goes against the previous results of Dementev and Gladkov (1967) suggesting that the Black Francolin placed a higher reliance on animal matter during summer and on vegetative matter during winter. The animal, however, was present in higher proportion (39 %) in the LSNP samples as compared with those collected from the cultivated tracts of the central Punjab, Pakistan (28 %: Khan, 1989). Cultivated wheat and maize were not present in the LSNP, yet seeds of these crops appeared in appreciable quantities in all the seasonal samples of the contents. These seeds were probably picked from the dirt tracks passing through the LSNP and used by the local inhabitants to carry their produce to the market or from the adjacent areas of the LSNP. A considerable parity between the proportional representation of different items and their constancy of appearance might indicate the casual picking of the food items, palatable to the species, as and when available.

The analysis of the seasonal samples indicated some variation in consumption of different types of the food during different seasons. Such a variation was expected under the relative availability of the food items in the area. Though direct data on relative abundance of food items was not available, yet higher abundance of insects and foliage could be expected during spring and summer and that of seeds in autumn and winter, under the rainfall and temperature regimen in the area. Further studies on association of the abundance of different food items in crop with availability in nature might help in understanding the species preference. The

chemical composition of the food items might provide important information on bioenergetics and thence the species preference to satisfy its energy requirements.

Grit frequently appeared in the stomach / crop contents of many species of birds including, Black Francolin (*Francolinus francolinus henrici;* Faruqi *et al*., 1960; Khan, 1989), Houbara Bustard (*Chlamydotis undulate macqueeni;* Mian, 1985), Grey Francolin (*Francolinus pondicerianus;*, Faruqi *et al*., 1960; Ullah, 1991; Mian and Wajid, 1994), and are some times believed to be picked up to satisfy the mineral requirements of the animals. The significant positive association of the grit with the seeds and negative association with animal and leaves part of the food supported the idea that the grit helped in churning of the harder food (seeds) in the stomach or crop. This is required in bird as the grinding is not possible in buccal cavity due to absence of teeth.

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REFERENCES

ALI, S. AND RIPLEY, S. D., 1969. *Handbook of the birds of India and Pakistan.* vol. III. Oxford University Press, Bombay, India.

ALI, S. AND RIPLEY, S. D., 1987**.** *Handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. 2nd ed. Oxford University Press, Delhi, India.

BUMP, G. AND BUMP, J. W., 1964. A study and review of the Black Francolin and the Grey Francolin. *Spec. Sci. Rep. Wildl*. (81): *Bur. Sport Fish. Wildl*., Washington, D. C. USA.

CHAUDHRY, A. A. AND. BHATTI, M. N., 1992. Biology of Black Francolin (*Francolinus francolinus*) in the central Punjab plains. Proc. 12th *Pakistan Congr. Zool.* Lahore: Pakistan, 160 – 161. (Abstract).

CRAMP, S. AND SIMMONS, K. E. L., 1980. *Handbook of the birds of Europe Middle East and North Africa*: *the birds of the western Palearctic*. vol. 2. *Hawks to Bustard.* Oxford University Press, Oxford, UK.

DEL HOYO, J., ELLIOTT, A. AND SARGATAL, J., 1994. *Handbook of the birds of the world. New world vultures to guineafowl*. Barcelona, Lynx (ed.), pp. 412-567.

DEMENT'EV, G. P. AND GLADKOV, N. A., 1967**.** *Birds of the Soviet Union.* Vol. 4. S. Monson, Jerusalem, Israel.

FARUQI, S. A., BUMP, G., NANDA, P. C. AND CHRISTENSEN, G. C., 1960. A study of the seasonal food of the Black Francolin {*Francolinus francolinus* (Linnaeus)}, the Grey Francolin {*Francolinus pondicerianus* (Gmelin)}, and the Commomn Sandgrouse {*Pterocles exustus* (Temminck)} in India and Pakistan. *J. Bombay nat. Hist. Soc*., **57**: 354 – 361.

IUCN. 2007. 2007 *IUCN red list of threatened species*. <www.iucnredlist.org>. (downloaded on June, 07, 2008).

JAVED, S., 1999. *Current status and conservation problems for Swamp Francolin* (unpublished report).

KHALEGHIZADEH, A. AND SEHHATISABET, M. E., 2006. Contribution to the knowledge of the diet of Iranian birds. *Ekoaorir*, **15**: 145 – 150.

KHAN, M. S., 1989. *Studies on the biology, habitat, distribution pattern, and food of the Black Partridge* (Francolinus francolinus) *in Tehsil Faisalabad*. M.Sc. thesis., Univer. Agri., Faisalabad, Pakistan, 118 pp.

KHAN, W. A., 2010. *Studies on the comparative ecology of the South Persian Black Partridge*, (Francolinus francolinus henrici) *and the Northern Grey Francolin (Francolinus pondicerianus interpositus) in Lal Suhanra National Park, Bahawalpur, Punjab, Pakistan*. Ph.D. thesis., PMAS Arid Agri. Univer., Rawalpindi, Pakistan. 218 pp.

LUM, T. M., 1986. The Black Francolin: an effective mouser? *Elepaio*, **46**: 155.

MIAN, A., 1985. *Biology of the Houbara Bustard (*Chlamydotis undulate macqueeni*) in Baluchistan*: 1984-85 *Wintering Population*, Rep. of World Wildlife Fund, Pakistan.

MIAN, A. AND WAJID, M. M., 1994. Food of Grey Francolin (*Francolinus pondicerianus*) in Layyah district (southern Punjab, Pakistan). *Pakistan J. Zool.,* **26**: 185-187.

MIAN, A. AND GHANI. U.I., 2007. Macro-biota variation under human protection in desert ecosystem of Cholistan, Pakistan. *J. Hum. Ecol*., **21**: 163-172.

NASIR, E. AND ALI, S. I., 1972 – 89. *Flora of Pakistan.* National Herbarium, Pakistan Agricultural Research Council, Islamabad, Pakistan 191Fascicles, No. 1– Flacourtiaceae, No.2 – Hamamelidaceae. No. 191, Boraginaceae.

QURESHI, J. I., 1972**.** Notes on the useful feeding activities of birds in field areas of Lyallpur. *Pak. J. agric. Sci*., **12**: 103-108.

RICHARDS, O. W. AND DAVIES, R. G., 1977. *Imm's general text of entomology*. vol. II., 10th Ed. Champan and Hall Ltd., London.

ROBERTS, T. J., 1991. *The birds of Pakistan*. Vol. I. *Regional studies and non-passeriformes.* Oxford Univ. Press. Karachi, Pakistan, pp. 598.

SOKAL, R.R. AND ROHLF, F.J., 2000. *Biometry: the principals and practice of statistics in biological research*. W. H. Freeman and Company, New York, USA. pp. 887.

ULLAH, H., 1991. *Studies on the biology, habitat, distribution pattern, and food of the Grey Partridg*e (Francolinus Pondicerianus) *in Tehsil Faisalabad*. M.Sc. thesis, University of Agriculture, Faisalabad, Pakistan. pp. 182.

YOUSUF, M. AND SIDDIQUI, E. M., 1989. *A guide to insect orders*. Department of Entomology, University of Agriculture, Faisalabad, Pakistan:14 pp.

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Table II.- Relative frequencies (%) of the different items of food recovered from the crops of the Black Francolin, killed during different seasons from Lal Suhanra National Park during 1998.

Food species	Spring (n=8)			Summer (n=7)			Autumn (n=6)			Winter (n=7)		
	Seeds	Leaves	Total	Seeds	Leaves	Total	Seeds	Leaves	Total	Seeds	Leaves	Total
Plant	**32.6±4.2**	**11.01±0.5**	**43.6±3.7**	**37.2±7.9**	**8.4±2.3**	**45.6±6.8**	**52.5±15.7**	**3.6±2.1**	**56.1±13**	**51.8±14**	**6.2±1.8**	**58.0±13**
Eleusine sp.	1.1±0.1	1.9±0.1	3.0±0.2	4.2±0.3	0.0±0.0	4.2±0.3	7.5±1.2	0.3±0.1	7.9±1.2	4.9±1.2	0.4±0.1	5.2±0.2
Triticum aestivum	5.2±0.2	0.0±0.0	5.2±0.2	4.8±0.2	0.0±0.0	4.8±0.2	5.0±1.1	0.0±0.0	5.0±1.1	3.1±0.2	0.0±0.0	3.1±0.2
Aristida sp.	3.1±0.1	00±0.0	3.1±0.1	1.9±0.1	0.0±0.0	1.9±0.1	5.8±1.1	0.0±0.0	5.8±1.1	2.4±0.2	0.0±0.0	2.4±0.2
Medicago satva	0.0±0.0	2.1±0.2	2.1±0.2	3.2±0.2	1.1±0.1	4.4±0.1	3.6±1.0	0.0±0.0	3.6±1.0	3.1±0.3	0.0±0.0	3.1±0.3
Lathyrus sp.	0.0±0.0	0.5±0.1	0.5±0.1	0.0±0.0	0.1±0.1	0.1±0.1	3.9±1.1	0.5±0.1	4.5±1.1	5.1±1.1	0.0±0.0	5.1±1.1
Cenchrus sp.	2.7±0.1	0.0±0.0	2.7±0.1	2.3±0.2	0.0±0.0	2.3±0.2	3.9±1.2	0.0±0.0	3.9±1.2	2.7±.0.2	0.4±0.1	3.1±.01
Dactyloctenium spp.	2.7±0.1	0.0±0.0	2.7±0.1	2.3±0.2	0.0±0.0	2.3±0.2	3.2±1.2	0.0±0.0	3.2±1.2	3.6±1.1	0.0±0.0	3.6±1.1
Acacia sp.	1.3±0.1	0.0±0.0	1.3±0.1	1.1±0.1	0.3±0.1	1.4±0.1	2.3±1.1	0.0±0.0	2.3±1.1	4.4±1.1	0.0±0.0	4.4±1.1
Pennisetum typhoides	1.5±0.1	0.0±0.0	1.5±0.1	1.9±0.1	0.0±0.0	1.9±0.1	4.1±1.4	0.0±0.0	4.1±1.4	2.1±0.2	0.0±0.0	2.1±0.2
Cyperus rotundus	1.9±0.2	0.0±0.0	1.9±0.2	0.3±0.1	0.0±0.0	0.3±0.1	0.5±0.1	0.0±0.0	0.5±0.1	3.5±1.1	0.0±0.0	3.5±1.1
Arnebia sp.	3.6±0.3	0.0±0.0	3.6±0.3	0.0±0.0	0.0±0.0	0.0±0.0	0.7±0.1	0.0±0.0	0.7±0.1	1.7±0.2	0.0±0.0	1.7±0.2
Suaeda fruticosa	0.0±0.0	0.0±0.0	0.0±0.0	1.9±0.1	0.0±0.0	1.9±0.1	1.9±0.1	0.0±0.0	1.9±0.1	1.7±0.2	0.0±0.0	1.7±0.2
Zea mays	2.3±0.2	0.0±0.0	2.3±0.2	0.5±0.1	0.0±0.0	0.5±0.1	1.6±0.1	0.0±0.0	1.6±0.1	1.3±0.1	0.0±0.0	1.3±0.1
Trifolium alexandrianum	0.0±0.0	1.1±0.1	1.1±0.1	2.7±0.2	1.1±0.1	3.8±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Prosopis juliflora	0.7±0.1	0.0±0.0	0.7±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	1.6±0.1	1.6±0.1	1.5±0.2	0.3±0.1	1.8±0.1
Launea resedifolia	0.0±0.0	0.5±0.1	0.5±0.1	0.0±0.0	0.5±0.1	0.5±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Solanum surattense	0.0±0.0	0.3±0.1	0.3±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	3.3±0.3	0.0±0.0	3.3±0.3
Fagonia cretica	0.0±0.0	0.0±0.0	0.0±0.0	0.5±0.2	0.0±0.0	0.5±0.2	0.0±0.0	0.0±0.0	0.0±0.0	2.9±0.2	0.0±0.0	2.9±0.2
Corchorus depressus	0.0±0.0	0.9±0.2	0.9±0.2	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	1.1±0.1	0.7±0.1	1.8±0.1
Capparis decidua	0.0±0.0	0.1±0.1	0.1±0.1	4.2±0.3	0.0±0.0	4.2±0.3	1.9±0.1	0.0±0.0	1.9±0.1	0.0±0.0	2.0±0.1	2.0±0.1
Polygala sp.	0.3±0.1	0.0±0.0	0.3±0.1	0.7±0.1	0.0±0.0	0.7±0.1	1.0±0.1	0.0±0.0	1.0±0.1	0.0±0.0	0.0±0.0	0.0±0.0
Chenopodium album	0.0±0.0	0.1±0.1	0.1±0.1	0.0±0.0	0.9±0.1	0.9±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Chenopodium murale	0.0±0.0	1.3±0.1	1.3±0.1	0.0±0.0	0.7±0.1	0.7±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Lasiurus sindicus	1.9±0.2	0.0±0.0	1.9±0.2	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Anticharis linearis	0.7±0.2	0.0±0.0	0.7±0.2	1.1±0.1	0.0±0.0	1.1±0.1	0.5±0.1	0.0±0.0	0.5±0.1	0.0±0.0	0.0±0.0	0.0±0.0
Indigofera sp.	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.5±0.1	0.5±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.7±0.1	0.7±0.1
Eragrostis sp.	1.1±0.2	0.0±0.0	1.1±0.2	0.0±0.0	0.3±0.1	0.3±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Leptadenia sp.	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	1.4±0.1	0.0±0.0	1.4±0.1	0.0±0.0	0.0±0.0	0.0±0.0
Fagonia sp.	0.0±0.0	0.0±0.0	0.0±0.0	0.7±0.1	0.0±0.0	0.7±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Panicum sp.	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	1.1±0.1	0.0±0.0	1.1±0.1
Atylosia sp.	0.0±0.0	0.7±0.1	0.7±0.1	0.0±0.0	0.7±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Solanum nigrum	0.0±0.0	0.1±0.1	0.1±0.1	0.0±0.0	0.2±0.1	0.2±0.1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Limeum indicum	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.5±0.1	0.5±0.1
Unidentified plant	1.9±0.2	0.9±0.1	2.8±0.3	2.1±0.21	1.5±0.1	3.6±0.1	2.7±0.1	1.0±0.1	3.7±0.1	2.0±0.2	1.1±0.1	3.1±0.1
Animals			**42.5±2.8**			**41.8±4.2**			**24.8±4.1**			**22.7±4.7**
Neotermes sp.			3.4±0.2			3.0±1.1			5.6±1.1			7.2±1.2
Homoptera			6.1±1.2			4.1±1.1			3.4±0.2			2.9±0.2
Staphylinidae			4.1±1.1			3.0±1.0			3.0±0.2			1.4±0.1
Diptera			4.4±1.1			4.0±1.0			1.6±0.1			2.2±0.2
Orthoptera			2.5±0.2			3.0±1.1			1.9±0.2			0.9±0.2
Coleoptera			4.0±1.1			5.0±1.1			3.2±0.1			1.4±0.1
Hymenoptera			2.4±0.2			3.5±1.1			1.0±0.1			1.4±0.1
Curculionidae			1.7±0.1			2.3±0.2			0.9±0.2			1.1±0.2
Aeshnidae			2.1±0.2			1.9±0.1			0.0±0.0			0.0±0.0
Cordulidae			1.7±0.1			2.70±1.2			0.0±0.0			0.0±0.0
Gryllidae			1.5±0.1			1.1±0.1			0.0±0.0			0.0±0.0
Lumbricus spp.			1.5±0.1			1.7±0.2			0.0±0.0			0.0±0.0
Unidentified Animal			6.8±1.2			5.9±1.2			3.8±0.4			3.8±0.2
Grit			8.0±1.7			9.0±2.1			15.3±2.1			15.1±2.1
Unidentified material			5.4±1.1			3.0±1.1			2.7±0.2			3.1±0.3