J. Glob. Innov. Agric. Soc. Sci., 2019, 7(2):73-78.
ISSN (Online): 2311-3839; ISSN (Print): 2312-5225
http://www.jgiass.com

DIET COMPOSITION OF A WILDLIFE SPECIES IN AGRI-ECOSYSTEMS OF FAISALABAD, PUNJAB, PAKISTAN

Usman Tiwana[1], Shahid Hafeez[2,*], Hafiz Masood Ahmad[2] and Habib ur Rehman[3]

[1]Pakistan Agricultural Research Council, Islamabad Pakistan;
[2]Department of Forestry and Range Management, University of Agriculture, Faisalabad, Pakistan;
[3]Punjab Bioenergy Institute, University of Agriculture, Faisalabad, Pakistan.
[*]Corresponding author's e-mail address: shahid_frw@uaf.edu.pk

The present study was carried out in three different tehsils of Faisalabad, to assess the food and feeding behavior of Asiatic Jackal (*Canis aureus*). Food items consumed by jackal in four different seasons (Spring, Summer, Autumn and Winter) were identified by stomach analysis of shot animals. Number of shot animals for each season was 10. Total number of shot animals for all seasons was 40. Twenty seven different types of food items were identified for all seasons from stomach contents. It included 19 plant species, 4 types of animal material and remaining was reptiles, insects, unknown plants and unidentified materials. Nine and eleven plant species were consumed by jackal in spring and summer seasons, respectively while in autumn and winter, only 7 plant species were consumed. Four types of animal matters were eaten by jackal in spring, summer and autumn while in winter, 3 types were consumed. Among crop plants, wheat (*Triticum aestivum*), sugarcane (*Saccharum officinarum*), maize (*Zea mays*) and sorghum (*sorghum bicolor*) were the most prominent species. Among trees, beri (*Zizyphus mauritiana*), shahtut (*Morus alba*), pipal (*Ficus religiosa*) and lasura (*Cordia myxa*) were consumed. Among animal food, domestic birds, domestic animals and rats were prominent. Among plant species, *Morus alba* with mean relative frequency 9.21 $\pm$ 4.82 was the most extensively consumed plant. Unknown plants were consumed in significant proportion ((3.75 $\pm$ 2.14). In animal contents, domestic birds (14.49$\pm$5.52) and domestic animals (10.79$\pm$6.65) were frequently consumed. Insects (2.42$\pm$2.42), unknown materials (8.55$\pm$4.81), unidentified matter (4.23$\pm$2.21) were consumed in different quantities. Asiatic jackal in the study area during all the four seasons, ranging from 40.06% to 53.48%, with maximum consumption occurring during winter season.

Keywords: Food, crops, trees, reptiles, insects, domestic birds and seasons.

INTRODUCTION

Asiatic Jackal (*Canis aureus*) is a medium sized brown grey animal. Its body weight is 7 to 12 kilograms. It likes arid, semi-arid to sub humid environment. It is abundant throughout the plains especially in the vicinity of agricultural fields and deserts (Anitei, 2008; Trouwborst *et al*., 2015). It likes to search dense vegetation or crop fields to hide. It is nocturnal and may move for many kilometers in search of food (Giannatos *et al*., 2010; Szabó *et al*., 2006). It generally feeds on garbage and human wastes (Lanszki *et al.,* 2006; Penezic and Ćirovic, 2015). Furthermore, it damages fruits like musk melon (*Cucumis melo*). Like other vertebrates, it is a serious pest of agricultural crops like wheat (*Triticum aestivum*), sugarcane (*Saccharum officinarum*), maize (*Zea mays*), sorghum (*sorghum bicolor*) and other grasses. Among trees, it damages and eats various parts of trees like beri (*Zizyphus mauritiana*) and shahtut (*Morus alba*). However, major portion of its food consists of rodents, reptiles and birds. It hunts animals even which are 4 to 5 times bigger of its body weight (Cirovic *et al*., 2014; Lovari *et al.,* 2009; Mukherjee *et al.,* 2004).

Despite its widespread distribution in Pakistan, locality wise and season wise, sufficient information is not available on its food preferences and feeding behavior (Atkinson *et al*., 2002; Lanszki and Heltai, 2002; Kaunda and Skinner, 2003; Mccarthy and Chapron, 2008). Present study was carried out to fill this research gap. As a result a better strategy may be designed for its control and further planning about its management. Faisalabad area was selected as a case study for this purpose. A brief review of the work carried out by various researchers in this context is presented below:

Research work was carried out on the feeding behavior of Asiatic Jackal in Potowar region. In that study, 98 fecal pallets were collected. It was revealed that frequency of plant biomass identified in fecal pallets was 54% while animal biomass was 46%. Wheat grains, beri (*Zizyphus mauritiana*), grasses and wild olive (*Olea cuspidata*) were consumed by jackal. Beri (*Zizyphus mauritiana*) was consumed throughout the year as it is a perennial plant. Consumption of small mammals and rodents was 67.7% while livestock carcasses were 8.4% (Nadeeem *et al.,* 2012). Diet of Asiatic Jackal was reported to be consisted of snakes, hare, quails and flamingoes (Jhala and Mohelmen, 2004).

It was reported that primacy food of jackal consisted of livestock carcasses in Serbia with bio percentage of 77.7%. Secondary food items included small mammals with a percentage of 4.2% while plant material, carnivores, dogs and lizards were consumed seldom (Cirovic *et al.,* 2014). A study revealed (Giannatos *et al.,* 2010) that most common food of jackal was mammals with a frequency of 42.7 and biomass 69.8%. Birds were consumed at a frequency of 12 and biomass 27.7%. The plant material and insects were consumed with a percentage of 27.3% and 18%, respectively. It has been reported (Tov *et al.,* 1995) that in Israel 2% calves of the total population are predated by jackals. The market value of these calves was 42,000 US Dollar. Most of the calves were killed within first week of delivery. Male calves were more attacked than female calves as female had more body weight.

MATERIALS AND METHODS

The experiment was conducted between June 2017 to June 2018, the whole study period was divided into four seasons: Spring (February-April); Summer (May-August); Autumn (September-October) and Winter (November-January).

Description of study sites

Name of Study site	Latitude	Altitude(m)
Chak Jhumra (I)	31.5629°N, 73.1881°E	172 m
Samundri (II)	31.0646°N, 72.9520°E	168 m
Sadhaar (III)	31.3661°N, 72.9431°E	157 m

***Preparation of Reference Slides*:** In different seasons, plant species from different study areas were collected. Reference slides were prepared by following standard methods (William, 1992). The required vegetative parts of the plants were obtained and dried. These fresh specimens/dried tissues were soaked in plant soaking solutions (distilled water, ethyl alcohol, and glycerin (1:1:1)) for a night then washed with tape water for about 10-20 min. Each specimen of plant tissue was ground in virtis homogenizer with distilled water. These contents were poured in micro sieve. This micro sieve was composed of 6cm long hollow cylinder having 0.05mm mesh of stainless steel wire that is fitted with a rubber stopper at one end of cylinder in such a way that it could be left filled with 1% sodium hypochlorite for clearing the specimen and was kept soaked in a sodium hypochlorite solution of 5% (Chlorax) and 4 parts of distilled water (1:4) for 20-30 minutes. To neutralize the basic effect of sodium hypochlorite equal amount of dilute acetic acid was added to the tissues and thereafter were placed in mordant solution for 15-30 minutes, and then this distilled water was dripped into the sieve to remove any basic residues.

The contents were placed in hematoxylin stain for 10-15 minutes, and then washed with tape water. On a clean slide a drop of apathy of mounting medium (100 cc distilled water and 100 g gum arabic) was placed. The stained plant material was mixed with this mounting medium with a wet camel brush and the material was uniformly spread over 22 × 40mm of slides. Two drops of mounting medium were added to the plant material and were covered with glass cover of 22 × 40mm and pressed tightly with a peril eraser for uniform contact of glass cover and slide. Labeling of slides was done for identification and was left at room temperature overnight for fastening of material on these studies.

The main features and cellular characteristic of each slide were studied and drawn on a note book as freehand drawing.

***Stomach Contents Analysis*:** Stomach contents analysis was carried out by using the methodology of Stomach contents analysis (Santos *et al.,* 2015). Stomach of each of the shot animal was immediately removed, after immobilizing and mid ventral cut, which was ligated on the both sides, and fixed in 10% commercial grade formalin and properly labeled with a field number. The field data on each individual like geographic location and date were recorded with reference to the field number. Samples were brought to the laboratory, where the contents of each stomach were removed and preserved in 10% formalin, in glass vials, for further analysis. The randomly selected parts of the stomach contents were cleared with running water over a sieve and placed in the Petri dish for macro-analysis. A white paper having equal-sized squares grid was placed below the petri dish where the fragments recovered from stomach were spread as a single layer, each item was identified directly through macroscopic examination by comparing with the reference plants. The numbers of fragments of different species of plants in seven different randomly selected boxes were recorded. The relative frequencies contributed by different species were worked out by suitable pooling of the individual data

The fragments left on the mesh were put in 70% alcohol for about 10 minutes and stained with light green dye to achieve differentiation. Permanent mounts were then prepared after passing through alcohol gradients. Seven focuses from each of seven slides, were examined under light microscope (60 X) and each piece in the focus was identified up to the lowest possible taxonomic category. The number of each species of plant parts in each box was calculated and the total number of the fragment was recorded.

The overall relative frequency was calculated as:

Relative frequency (%) = (Total no. of fragments of a species) / (Total number of fragments analyzed) × 100

The relative frequency of different food items recorded from the stomach content was compared in different areas and seasons to work out the feeding preference of the species.

RESULTS

The presented study was conducted in three different localities viz., Chak Jhumra, Samundri city and Sadhaar bypass, in District Faisalabad. Different parameters such as

mean relative frequency of different types of food materials, their percent volume and then seasonal variation of consumed food in stomach of Asiatic Jackal was analyzed.

Data regarding corporeal characteristics of Asiatic Jackal (scat samples) collected during the experimental period of projected study (Table 1) indicated that highest average weight (8.89 g) of sample was recorded form Chak Jhumra followed by 8.76 g (in Samundri) and whereas relatively low (8.64 g) was observed in Sadhaar.

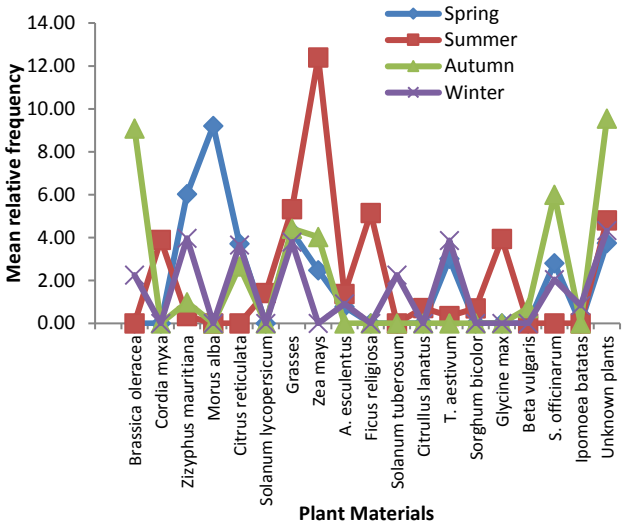

Figure 1. Overall mean relative frequency of different plant species for Asiatic Jackal in different seasons from District Faisalabad.

The analysis of spring samples of stomach contents (n=10) revealed that 9 plant species and 4 types of animal matters were consumed by Jackal (Table 1). Among plant species, shahtut (*Morus alba)* with mean relative frequency 9.21± 4.82 was the most extensively consumed in this season. Beri (*Zizyphus mauritiana)* (6.03±2.77) and grasses (4.27±2.640) were consumed in second and third most frequent amounts while *Citrus reticulata* (3.71±2.05), *T. aestivum* (3.01±1.62), *S. officinarum* (2.80±*2.43)*, *Z. mays* (2.48±1.04), were utilized relatively less frequently. Unknown plants consumed in significant proportion were (3.75±2.14).

The summer data revealed that 11 plant species, 4 types of animals matters, insects and reptiles were consumed by Jackal (Table 1). Among these, *Z. mays* with mean relative frequency (12.39±6.92) was the most extensively consumed in this season, *Grasses* (5.55±4.24) stood second while *F. religiosa* (5.15±2.91), unknown plants (4.81±3.55), *Glycine max* (3.94±2.68*)*, *C. myxa* (3.90+3.30), were utilized in relatively less frequently. *Abelmoschus esculentus* (1.38±0.35) was lowest of the total contents.

The autumn data analysis showed that 7 plant species, 4 types of animals matters, insects and reptiles were consumed by Jackal. Among these *B. oleracea* with mean relative frequency (9.09±4.09) was the most extensively consumed in this season. *S. officinurum* (6.00+3.25) and *Grasses* (4.24±3.33), were in sufficient amount while *Z. mays* (4.03±1.43), *C. reticulata* (2.65±2.95) were utilized relatively less frequently.

The analysis of winter samples of stomach contents revealed that 7 plant species 3 types of animals matters, insects and reptiles were consumed by jackal (Table 1). Among these unknown plants with mean relative frequency (4.32±2.67) were the most extensively consumed in winter season. *Z. mauritiana* (3.97±2.59), *Grasses* (3.79±2.66), *B. oleraca* (2.26±1.70) were in sufficient amount while *Z. mays* (4.03±3.43), *C. reticulata* (3.65±1.90) were utilized relatively less frequently.

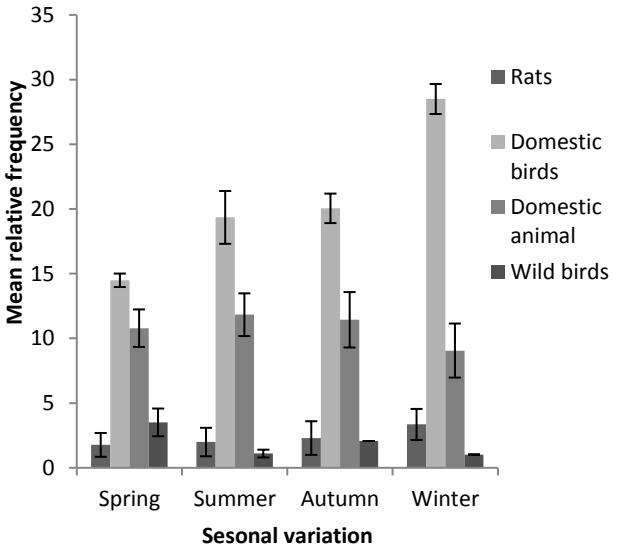

Figure 2. Overall mean relative frequency of different animal species for Asiatic Jackal in different seasons from District Faisalabad.

Table 1. Corporeal characteristics of Asiatic jackal (scat samples) collected during the experimental period of projected study.

Study area/site	Sample size (N= 90)	Average weight (g)	Average length (cm)	Average width (cm)
Chak Jhumra (I)	30	8.89 ±0.50	5.63±0.13	1.34±0.03
Samundri (II)	22	8.76±0.52	5.37±0.16	1.25±0.05
Sadhaar (III)	19	8.64±0.52	5.18±0.16	1.30±0.05

Data regarding mean frequency of animal contents revealed that in animal contents, domestic birds (14.49±5.52) and domestic animals (10.79±6.65) were frequently consumed. Wild birds (3.51±2.47) and rats (1.77±0.92) were less frequent in animal matters. Insects (2.42±2.42), unknown materials (8.55±4.81), unidentified matter (4.23±2.21) were consumed in different quantities.

Findings regarding consumption of animal matter in summer disclosed that animal contents, domestic birds (19.35±9.44) and domestic animals (10.79±5.65) were most frequently consumed. Rats (1.99±1.50) were less frequent in animal matters. In others, unidentified (8.16±3.19), insects (2.52±1.52) of summer diet comprised of hair spine and bone particle.

The outcomes of study during autumn revealed that domestic birds (20.05±9.12) and domestic animals (11.44±6.69) were frequent. Rats (2.30±1.30) and wild birds (2.07±1.05) were less frequent in animal matters. In others unidentified (2.90±1.79), autumn diet comprised of hair spine and bone particle contribute significantly of the total contents. In autumn season, the animal matter was consumed in slightly less proportion as compared to the rest of three seasons (winter, spring and summer). The anthropogenic items were higher in autumn season and lowest in winter season.

In animal contents in winter, domestic birds (28.50±11.66) and domestic animals (9.06±5.09) were frequent. Rats (3.35±1.20) were less frequent in animal matters. In others unknown (10.68±5.00), unidentified (7.82±3.71), insect (2.14±1.10) winter diet comprised of hair spine and bone particle contribute significantly of the total contents.

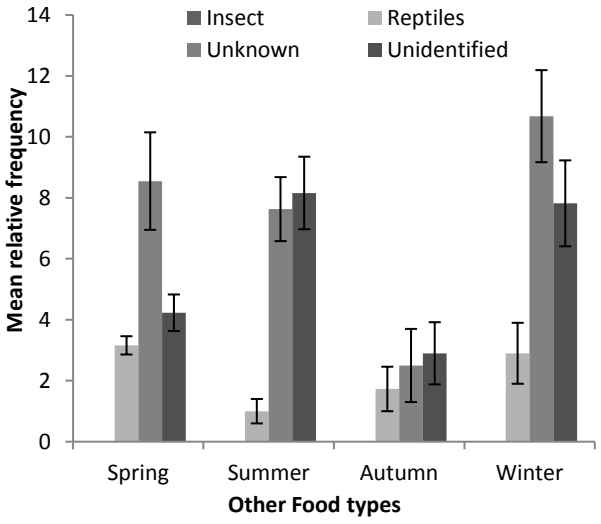

Figure 3. Overall mean relative frequency of other food type for Asiatic jackal in different seasons from District Faisalabad.

Data of spring showed that insects (2.42±2.42), unknown materials (8.55±4.81), unidentified matter (4.23±2.21) were consumed in different quantities. Findings of summer disclosed that unidentified (8.16±3.19), insects (2.52±1.52) of summer diet comprised of hair spine and bone particle. Unidentified (2.90±1.79), autumn diet comprised of hair spine and bone particle contribute significantly of the total contents in diet during autumn. Whilst in winter season, unknown (10.68±5.00), unidentified (7.82±3.71), insect (2.14±1.10) winter diet comprised of hair spine and bone particle contribute significantly of the total contents.

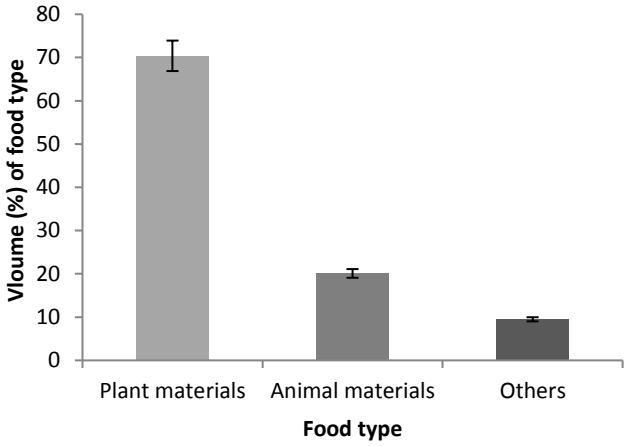

Figure 4. Percent volume of different type of food recorded during study in District Faisalabad.

Findings in (fig. 1) revealed that 70.4 % volume of food was plant type food at the study sites, 20.1% was animal food while 9.5 % was the other including insects, reptiles etc. The plant species were the most abundant one at the three studies cites (Chak Jhumra, Samundri city and Sadhaar bypass).

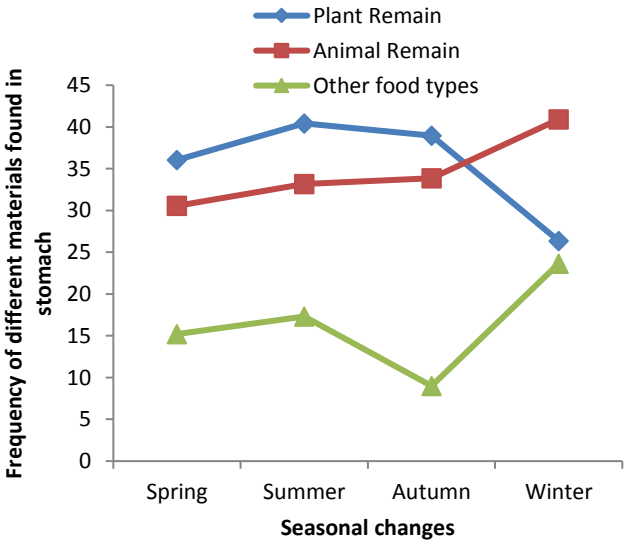

Figure 5. Percent of different type of food recorded from stomach of Asiatic Jackal during study in District Faisalabad.

The data presented in (Fig. 5) indicated that in the stomach contents of the Jackal, 27 different types of food items were identified collectively for all seasons. Plant remains were 36.04, 40.43, 38.97 and 26.3 %, Animal remain were 30.56, 33.17, 33.86 and 40.91% whereas other food materials were 15.2, 17.31,9 and 23.64% during Spring, Summer, Autumn and Winter season, respectively.

DISCUSSION

The current study was geared to work out the different seasonal diets and the fluctuations of diets during four seasons viz., Spring, Summer, Autumn and Winter. Data regarding mean frequency of animal contents revealed that domestic birds (14.49±5.52) and domestic animals (10.79±6.65) were frequently consumed. Wild birds (3.51±2.47) and rats (1.77±0.92) were less frequent in animal matters. Insects (2.42±2.42), unknown materials (8.55±4.81), unidentified matter (4.23±2.21) were consumed in different quantities. The earlier studies Kaunda and Skinner (2003) on Black-backed jackal diet support the findings of the current study that most common food items of Asiatic Jackal during spring were animal contents. Mukherjee *et al*. (2004) conducted a study about the role rodents in the diet of golden jackal. The findings confirm our results for the spring season. Animals were a more important source of food in spring season than the winter where mammalian and bird biomass consumption rose to 78.2% and 16%, respectively.

In animal contents domestic birds (20.05±9.12) and domestic animals (11.44±6.69) were frequent. Rats (2.30±1.30) and wild birds (2.07±1.05) were less frequent in animal matters. In others unidentified (2.90±1.79), autumn diet comprised of hair spine and bone particle contributed significantly of the total contents. Mahmood *et al*. (2013) study confirmed the autumn season only. In Autumn season, animal matter was consumed in slightly less proportion as opposed to the rest of three seasons (winter, spring and summer). The anthropogenic items were higher in autumn season and lowest in winter season. Kaunda and Skinner (2003) showed that most common food item during autumn season was mammals (25.8 %).

In animal contents, domestic birds (28.50±11.66) and domestic animals (9.06±5.09) were frequent. Rats (3.35±1.20) were less frequent in animal matters. In others, unknown (10.68±5.00), unidentified (7.82±3.71) and insects (2.14±1.10) were also present in winter diet. Hair spine and bone particles contributed significantly to the total contents. Kaunda and Skinner (2003) confirmed our findings that consumption of animal matter was predominant as compared to plant matter in the diet of the Asiatic Jackal in the study area during all the four seasons, ranging from 40.06% to 53.48%, with maximum consumption occurring during winter season.

Conclusion: This study indicated that food of Asiatic Jackal included maximum variety of plant materials while animals, insects and reptiles stood second in their diet composition. Nine types of crops were consumed by Jackal. This study proved that jackal is a serious vertebrate pest of farm crops, citrus fruits and other trees.

REFERENCES

Anitei, S., 2008. Jackal: The God of the Dead or Just the Little Wolf of the Savanna? Soft-pedal; pp.1- 2

Atkinson, R.P., D.W. Macdonald and R. Kamizola, 2002. Dietary opportunism in side-striped jackals (Canis adustus, Sundevall). J. Zool. London. 257:129-140.

Cirovic. D., A. penezic, M. Milenkovic and M. Paunovic. 2014. Winter diet composition of the Golden Jackal in Serbia. Mamm. Bio. 79:132-137.

Giannatos, G., A. Karypidou, A. Legakis and R. Polymeni. 2010. Golden jackal (*Canis aureus* L.) diet in Southern Greece. Mamm. Bio. 75:227-232.

Jhala, Y.V. and P.D. Mohelmen. 2004. Golden jackal action plan. IUCN?/SSC Canid Specialist Group, Gland, Switzerland and Cambridge, UK; pp.156-161.

Kaunda, S.K.K. and J.D. Skinner. 2003. Black-backed jackal diet at Mokolodi Nature Reserve, Botswana. Afr. J. Eco. 41:39-46.

Lanszki, J. and M. Heltai. 2002. Feeding habits of golden jackal and red fox in south-western Hungry during winter and spring. Mamm. Biol. 67:129-136.

Lanszki, J., M. Heltai and L. Szabo. 2006. Feeding habits and trophic niche overlap between sympatric golden jackal (*Canis aureus*) and red fox (*Vulpes vulpes*) in the Pannonian ecoregion (Hungry). Canad. J. Zool. 84:1647-1656.

Lovari, S., R. Boesi., Minder., N. Mucci., E. Randi., A. Dematteis and S.B. Ale. 2009. Restoring a keystone predator may endanger a prey species in a human altered ecosystem: the return of the snow leopard to Sagarmatha National park. Animal conservation. The Zool. Soci. London; pp. 1-12.

Mahmood, T., F. Niazi and M.S. Nadeem. 2013. Diet composition of asiatic jackal (*Canis aureus*) in Margallah Hills National Park, Islamabad, Pakistan. J. Anim. Pl. Sci. 23:444-456.

Mccarthy, T. M. and G. Chapron. 2008. Snow Leopard Survival Strategy. International Snow LeopardTrust and Snow Leopard Network, Seattle, USA; pp. 104.

Mukherjee, S., S.P. Goyal, A.J.T. Johnsingh and M.R.P.L. Pitman. 2004. The importance of rodents in the diet of Jungle cat (*Felis chaus*), Caracal (*Caracal caracal*) and golden jackal (*Canis aureus*) in Sariska Tiger Reserves, Rajasthan, India. J. Zool. Lond. 262:405-411.

Nadeeem, M.S., R. Naz, S.I. Shah and M.A. Beg. 2012. Season- and locality-related changes in the diet of Asiatic

jackal (*Canis aureus*) in Potohar, Pakistan. Turk. J. Zool. 36:798-805.

Penezic, A. and D. Ćirovic. 2015. Diet of adult and juvenile golden jackals (*Canis aureus*) during cubs` dependency stage. Balkan J. Wildlife Res. 2:27-32.

Santos, T., C. Fonseca, T. Barros, R. Godinho, C. Bastos-Silveira, V. Bandeira and R.G. Rocha. 2015. Using stomach contents for diet analysis of carnivores through DNA barcoding. Wildlife Biology in Practice. 11:31-39.

Szabó, L., M. Heltai, J. Lanszki. 2006. River Tiscia as a green corridor in the psread of golden jackal in Hungary, Vadbiológia; pp. 47-54.

Tov, Y.Y., S. Ashkenazi and O. Viner. 1995. Cattle predation by the golden jackal *Canis aureus* in the Golan Heights, Israel. Mamm. Cons. 73:19-22.

Trouwborst, A., M. Krofel and J.D. Linnell. 2015. Legal implications of range expansions in a terrestrial carnivore: the case of the golden jackal (*Canis aureus*) in Europe. Biodiversity and Conservation. 24:2593-2610.

William, O. 1992. The techniques for studying microtine food habits. J. Mammal. 43:360-365.