RESEARCH ARTICLE

ECOLOGICAL STUDIES OF HABITAT AND FEEDING OF WILD UNGULATES IN THE THAR REGION OF JODHPUR, RAJASTHAN (INDIA)

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ARTICLE INFO	ABSTRACT
	The utilization of different habitats was influenced by availability of preferred food plants as well as human interference through different activities. We studied the habitat utilization by wild ungulatesnamely Blackbuck (*Antelope cervicapra*) and Chinkara (*Gazellabennetti*) in non-closed area of Jodhpur. Data obtained from different study sites were compared by correlating the percentage time spent on different plant species during different seasons.We collected the data from different habitat of arid region of Jodhpur during August 2003 to July 2005. A review of information available on the food plants and preferred habits of wild Thar ungulates revealed that the both wild ungulate Blackbuck and Chinkara spent maximum time in HCF during summer and monsoon season. Analyses of the compiled data on food plants show that the *Crotalaria burhia* was the most dominant plant species with 74.11 of Importance Value Index (IVI) at JajiwalDhora and with 74.45 of IVI at Surpura area of Jodhpur.

INTRODUCTION

An animal's utilization of the habitat is defined by its need for food and the constraints involved, both extrinsic and intrinsic (Krebs and Davis, 1984) and Animals are expected to respond to the properties on offer in a particular habitat. Thus it is important to recognize the different categories of habitat that an animal can choose from in order to meet its requirements of food, cover and water. The prime consideration of habitat selection by wild ungulate namely Blackbuck (*Antelope cervicapra*) and Chinkara (*Gazellabennetti*), other than availability of food and protection, are a long range view–namely eye sight is given full scope and secondly, but almost as important is ground where high speed could be obtained to effect escape (Gehlot, 2006). The Blackbuck (*Antelopecervicapra*) population has refuge in Thar Desert due to the protection afforded by the local *Bishnoi* community; however, the chinkara(*Gazellabennetti*)population is more spread in the Thar Desert even in areas where *Bishnoi* community is not found (Gehlot, 2006).The natural habitat of blackbuck is the arid and semi-arid grasslands of India and Pakistan. They live on open plains and avoid hilly and forested area (Mungall, 1978).

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Habitat preference of Blackbuck and Chinkara obtained from selected study sites were compared by correlating the percentage time spent on different habitats in different seasons via scan focal sampling. We studied habitat preference of the Indian gazelle and the Indian antelope from August 2003 to July 2005 in the selected habitats of non-closed areas Surpura and JajiwalDhora of Jodhpur.

MATERIALS AND METHODS

Study area

Two intensive areas JajiwalDhora and Surpura of Jodhpur district were selected for habitat study (Fig. 1). The JajiwalDhora study site of JajiwalDhora village is 25 km north east of Jodhpur near Jaipur-Jodhpur highway. It lies between N26°19.908' and E73°22.978'. This area does not belong to closed area, but has fairly good numbers of Chinkara. During monsoon season, large area of this study site is put under cultivation for crops. Another study site Surpurais 22 km towards northeast of Jodhpur city and lies between N 26°22.329' E 73°06.618'. It has not been declared as a closed protected area; however it supports good number of the Blackbuck.

Methods

Quadrate Method was used for study of habitats, three transects, each of one km long, were randomly placed within the intensive study areas for quantifying the habitat to study vegetation parameters. At each 100 mt point, on the each transect a quadrate measuring 100 sqmt, was placed to find out the quantitative and qualitative abundance of different flora. This process was repeated in each season. Further for more detail study of small grasses, two sub quadrates measuring, 0.5mt X 0.5mt were laid down within 10 mt radius plot and Percent ground and grass cover, Number of plants species, Species and number of individuals were recorded. These basic quantitative vegetation ecology parameters were used to measure relative importance of species and to determine the dominant species using Important Value Index in vegetation of study site. The relative importance of each species in the community was computed in terms of relative frequency (RF), relative density (RD) and relative abundance (RA). The relative values were computed by using the general functions

$$Rv = Xv / \sum Xv \,.100$$

The sum of three relative values was considered as Important Value Index   IVI= RF+RD+RA

For statistical analysis of habitat, the behavioural data were recorded in the ratio scale and the vegetation data were expressed in the percentages. Since the sampling technique was random and the each study area being more or less homogeneous, percentages expressed were translated to the whole habitat. Window based SPSS and Excel programmes were used for statistical analyses and for carrying the rigorous statistical analysis preparing graphical representation at the study area.Relation between the habitat and forages consumed by the animal indicates Utilization of niche by the animals in relation to availability of forages. It is expressed in terms of Relative Preference Index (PRI) and was calculated following,

Putman (1986):

$$PRI = \frac{\% \ utilization}{\% \ availability}$$

RESULT AND DISCUSSION

The free living wild ungulates (Blackbuck and Chinkara) are found inthe desertic habitats of Thar region of Rajasthan. The selected study areas of thar region were divided into six habitats on the basis of land use pattern and these are (1) Recently harvested crop field (RHCF), (2) Harvested crop field (HCF), (3) Fallow land 3 (FL 3), (4) Fallow land 4 (FL 4), (5) Scrub land (SL) and (6) Hedge Row (HR). JajiwalDhoraintensive study site was selected for the study of chinkara. It was also divided into six habitats and mainly comprised of RHCF and HCF (51.68 %) followed by Fallow lands (37.92 %) and Scrubland and hedges rows are about 10.40% (Table 1).While the Surpura studysite was selected for study of blackbuck, as it was outside of the declared closed area. Most of the area of this site (68.83%) was under cultivation (RHCF and HCF), followed by (12.73%) fallow

land (FL 3 and FL 4), and (12.63%) was under scrubland as gauchar and Oran (Table 2).

Table 1. Different habitats used by Chinkara (season wise) at JajiwalDhorastudy site

Habitat Categories	Area (In sq.km)	Area Percentage	Habitat used (%) bychinkara		
			Winter	Monsoon	Summer
RHCF	1.90	51.68	49.29	31.01	47.14
HCF	1.33		17.66	9.15	30.18
FL 3	0.62	37.92	8.33	17.86	7.03
FL 4	1.75		12.88	26.33	1.20
SL	0.25	10.40	3.84	11.32	11.08
HR	0.40		8.0	4.33	3.18

Table 2. Different habitats used by Blackbuck (season wise) at Surpura study site

Habitat Categories	Area (In sq.km)	Area Percentage	Habitat used (%) by Blackbuck		
			Winter	Monsoon	Summer
RHCF	5.04	53.05	64.33	8.64	10.22
HCF	1.5	15.78	8.74	55.73	51.39
FL 3	0.81	8.52	7.17	5.91	7.33
FL 4	0.4	4.21	3.81	3.49	5.66
SL	1.2	12.63	9.73	16.42	18.69
HR	0.55	5.78	6.22	09.81	6.11

During study period *Crotalaria burhia* was found more frequent, abundant and denser with 8.86% of relative frequency, 24.45 % of relative abundance and 40.8% of relative density, however this composition was found mainly in RHCF, HCF, FL3 and FL4 but not in scrub land of JaijwalDhora where the *Crotalaria burhia* was the most dominant plant species with 74.11 of Importance Value Index (Table 03) while *Crotalaria burhia* was also more frequent, denser and abundant with 8.75 % of relative frequency, 39.70 % of relative density and 26.0 % of relative abundance and followed by 24.45 % of agricultural crops in monsoon at Surpura study area where the *Crotalaria burhia* was the most dominant plant species with 74.45 of Importance Value Index (Table 4).During the present study, the both wild ungulate Blackbuck and Chinkara spent maximum time in HCF during summer and monsoon.

The Relative Preference Index (PRI) showed high preference for HCF with 2.83 during monsoon and 3.25in summer season by Indian gazelle at JajiwalDhora study site in all the three seasons except during winter season where PRI was high (2.64) for scrubland habitat(Fig 02). The Chinkara prefer the maximum time in HCF during summer and monsoon seasons and the habitats were used HCF > RHCF > FL > SL > HR whereas during winter the habitats were used in the order of SL > HCF > HR > FL > RHCF. Whereasthe PRI for habitats used indicates that during summer and monsoon HCF was mostly preferred against other habitats with 3.25 and 3.53 PRI respectively but PRI was high (1.21) for RHCF habitat during winter season at Surpura study site (Fig 3). The Blackbuckspent maximum time in HCFduring summer and monsoon and the habitats were utilized by blackbuck in order of HCF > SL > HR> FL>RHCF while RHCF> HR > FL>SL >HCF during winter. The same observation has been already noted by Goyal *et al.* (1986 and 1988); Ghosh*et.al.,* (1984 and 1987); Gehlot and Jakher, (2011) in this region. In spite of the blackbuck's main reliance on grasses as grazers, however

**Table 3. Relative importance of floral species in JajiwalDhora**

S.N.	Plant Species	Basic Quantitative Parameters			Relative Values (%)			IVI
		Frequency	Abundance	Density	RF	RA	RD	
1	*P. cineraria*	85.71	1.5	1.28	7.59	1.97	2.81	12.37
2	*C. burhia*	100	18.57	18.57	8.86	24.45	40.8	74.11
3	*C. decidua*	85.71	1.83	1.57	7.59	2.41	3.44	13.44
4	*M. emarginata*	8.71	4.5	3.85	7.59	5.92	8.45	21.96
5	*Z. nummularia*	71.42	2.6	1.85	6.32	34.24	4.06	44.62
6	*A. nilotica*	71.42	1.4	1.0	6.32	1.84	2.19	10.35
7	*B. aegyptiaca*	28.57	2.0	0.57	2.53	2.63	1.25	6.41
8	*C. procera*	85.71	2.33	2.0	7.59	3.06	4.39	15.04
9	*T. undulata*	85.71	1.33	1.14	7.59	1.75	2.50	11.84
10	*S. persica*	57.14	1.0	0.57	5.06	1.31	1.25	7.62
11	*L. pyrotechnica*	85.71	3.83	3.28	7.59	5.04	7.20	19.83
12	*L. barbarium*	71.42	2.4	1.71	6.32	3.16	3.75	13.23
13	*A. senegal*	-	-	-	-	-	-	-
14	*C. pendulus*	42.85	1.33	0.57	3.79	1.75	1.25	6.79
15	*Aerva*spp.	71.42	2.6	1.85	6.32	34.24	4.06	44.62
16	*Cenchrus*spp.	71.42	2.2	1.57	6.32	2.89	3.44	12.65
17	Agricultural crops	14.28	24.0	3.42	1.26	31.61	7.51	40.38
18	Un identified Plants spp	14.28	2.5	0.71	1.26	3.29	1.56	6.11
	Total	1128.48	75.92	45.51				

Table 4. Relative importance of floral species in Surpura study site

S.N.	Plant Species	Basic Quantitative Parameters			Relative Values(%)			IVI
		Frequency (%)	Abundance	Density	RF	RA	RD	
1	*P. cineraria*	85.71	2.83	2.42	7.50	3.84	5.02	16.36
2	*C. burhia*	100	19.14	19.14	8.75	26.0	39.7	74.45
3	*C. decidua*	85.71	4.33	3.71	7.50	5.88	7.69	21.07
4	*M. emarginata*	42.85	1.33	0.57	3.74	1.80	1.18	6.72
5	*Z. nummularia*	85.71	5.5	4.71	7.50	7.47	9.77	24.74
6	*A. nilotica*	71.42	0.02	1.42	6.24	2.71	2.94	12.89
7	*B. aegyptiaca*	42.85	1	0.42	3.74	1.35	0.87	5.96
8	*C. procera*	85.71	2.0	1.71	7.50	2.71	3.54	13.75
9	*T. undulata*	57.14	1.5	0.85	5.0	2.03	1.76	8.79
10	*S. persica*	57.14	1.5	0.85	5.0	2.03	1.76	8.79
11	*L. pyrotechnica*	85.71	2.5	2.14	7.50	3.39	4.43	15.32
12	*L. barbarium*	71.42	2.2	1.57	6.24	2.98	3.25	12.47
13	*A. senegal*	-	-	-	-	-	-	-
14	*C. pendulus*	57.14	1.6	0.71	5.0	2.17	1.47	8.64
15	*Aerva*spp.	85.71	3.16	2.71	7.50	4.29	5.62	17.41
16	*Cenchrus*spp.	71.42	2.0	1.42	6.24	2.71	2.94	11.89
17	*Agricultural crops*	14.28	18.0	2.57	1.24	24.45	5.33	31.0
18	*Un identified Plants* spp.	42.85	3.0	1.28	3.74	4.07	2.65	10.46
	Total	1142.77	73.59	48.2				
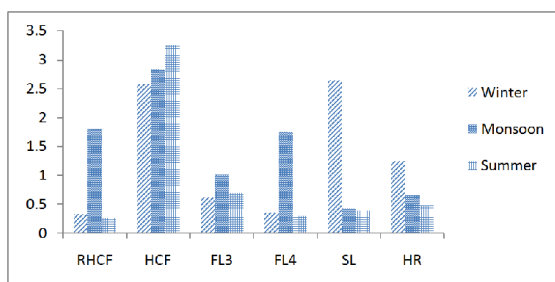
Figure 2. PRI in relation to habitats used by Chinkara in JajiwalDhora study site
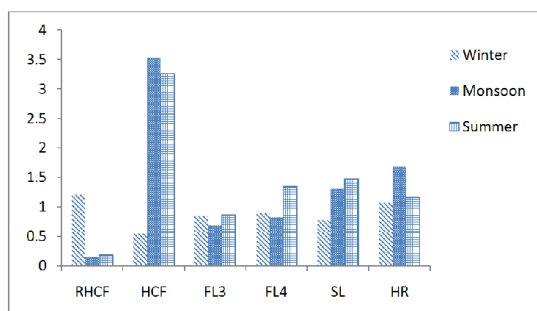
Figure 3. PRI in relation to habitats used by Blackbuck in Surpura study site

Fig. 01: Intensive study areas of Jodhpur district

leaves, pods, flowers and fruits normally formed portion of the diet during different seasons of the year. The Blackbucks were found mostly grazing on *Dactylocteniumaegyptium, Eleusinecompressa, Cenchruscillaris, Cynodondactylon, Desmostachyabipinnata*and *Cyperus* grass species.At Surpurastudy site composition and abundance of various preferred plants were slightly different.

Here *Prosopis cineraria, Capparis deciduas Crotalaria burhia, Salvadorapersica and Lyciumbarbarium*a bundance were greater and blackbuck frequently utilized parts of *Calotropisprocera* and *C. burhia*. Indian gazelle is a browser as well as grazer. The foraging pattern was shifted in chinkara with the changing seasons and availability of preferred food plants. Once the dried grass became nutritionally poor, the animal also shifted feeding on fallen leaf litter of preferred plants like *Prosopis cineraria, Ziziphusmauritiana, Maytenusemarginata, Acacia senegal, Tecomellaundulata* and *Salvadorapersica*while generally, Chinkara are grazing on grasses like *Dactylocteniumaegyptium, Eleusinecompressa, Cenchruscilliaris, Cynodondactylon, Desmostachyabipinnata* and *Cyperus* species. Similar observation was noted by Ghosh *et al*. (1987). He observed that Chinkara feed on *Acacia torta* leaves and pods but other species like *Balanitesaegyptiaca, Capparis decidua, Prosopis cineraria, Salvarodapersica* and *Ziziphusnummularia* with few grasses were also grazed in Jodhpur region (Sharma 1977). In winter, the gazelles were mostly seen in the RHCF and they were mostly found under *Tecomellaundulata*tree in early morning to eat fallenflowers (Gehlot, 2006). *Crotalaria burhia*was most preferred food plant for chinkara during winter season but during monsoon a wide diversity of shrubs and grasses was available as forage thus chinkara spent more time in harvest crop fields (HCF), fallow land and scrub land and grazed on grasses like *Tribulusterrestris, Eleusinecompressa, Digeramuricata, Mollugo*spp*., Cenchrus*spp.and many more unidentified grass species. Such changes in the ecosystem have been aggravated due to changes in land use pattern that altered the vegetation compositions of the ecosystem (Rahmani, 1990). Even without taking optimality into consideration the foraging behaviours of the Indian gazelle and blackbuck need to be understood as there are little information regarding the species in literature and to understand their feeding with reference to habitat utilization.

When these plants dry up in summer, the chinkara feed on the green leaves of *Maytenusemarginata* and to some extent on the energy and moisture-rich pods of *P. cineraria* (Bohra *et al.,* 1992). In the saline desert tract of Israel, the pods of Acacia species reportedly form a considerable part of diet of Gazelladorcas (Baharav 1981, 1983). Roberts (1977) observed that the gazelles in the Cholistan desert region of Pakistan browse on *Leptadiniaspartium* and *Acacia jacquemonti* during the early part of summer. Similarly various studies have been conducted on habitat selection and food preference on different gazelle species by Goyal *et al.* (1986); Baharav, (1981); Grettenberger and Newby, (1986) Mohamed *et al.* (1991); Loggers, (1991) in India.

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