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THE DEN AND DENNING BEHAVIOUR OF DESERT FOX *(VULPES VULPES PUSILLA* BLYTH, 1854) IN DESERT NATIONAL PARK SANCTUARY, RAJASTHAN

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Desert Fox *(Vulpes vulpes pusilla)* is a sub species of Red Fox. It is the smallest and lightest of all the three subspecies found in India. It prefers the scrub forest habitat. The distribution pattern of desert fox greatly depends upon its food which is composed of desert dwelling small mammals and certain fruits of desert plants. The present paper describes denning behaviour of a Desert Fox, *Vulpes vulpes pusilla*. The investigations were made at the Sudasari, Khuri and Kanoi sites in the Desert National Park sanctuary, spread in Jaisalmer and Barmer districts of Rajasthan. These studies were made by applying direct observation techniques and comparisons were made from the neighbouring natural environment of the study area. Maximum number of dens was found in the basal area of Ker *(Capparis decidua)* plants. In most of the cases openings of the dens helped the fox to escape from its den at the time of threat. It was not hunted by the local people but Jogi (a Tribe inhabiting in the area) hunt them for meat with the help of their dogs.

The Red Fox *(Vulpes vulpes)* is distributed all throughout Northern Hemisphere extending from the Arctic Circle to North Africa, Central America and Asia[1]. Wozencraft[2] consolidated forty five subspecies of Red Foxes. Sacks, et. al.,[3] expressed possible occurrence of one more subspecies, based upon their investigations applying mitochondrial haplotype studies from the Sacramento valley.

These subspecies of Red Foxes have been divided into two categories: *viz*. large and bright coloured Northern foxes which are limited to the northern Hemisphere and the small Southern foxes which are confined to Asia and Middle East[4]. Out of the known forty six subspecies, three subspecies of Red Fox are found in India: *Vulpes vulpes montana* (Tibetan Red Fox), found in Laddakh and the Himalayas, *Vulpes vulpes griffithi* (Kashmir Fox), found in Jammu and Kashmir (except the Laddakh region), and *Vulpes vulpes pusilla* (Desert Fox) found in the Thar Desert, Rajasthan and in Kutch, Gujarat. A subspecies, the Japanese Red Fox *(Vulpes vulpes japonica)* migrated from India to China and eventually to Japan.

Desert Fox *(Vulpes vulpes pusilla)* is a sub species of Red Fox reported from Baluchistan, Rawalpindi, Rajputana, Kutch, southern Iran and Iraq[5,6]. It is the smallest and lightest of all foxes found in India[7]. It is also known as white footed fox and possesses short, grayish fur mixed with rust-brown hair[8]. It is smaller than the Afghan red and hill foxes, and never exhibits a red phase in its winter coat, nor the silvery, hoary phase of the Afghan Red Fox[5]. The distribution pattern of desert fox greatly depends upon its food which is composed of desert dwelling small mammals and certain fruits of desert plants. The number of breeding dens is an important indicator of reproductive success and therefore it can be regarded as a reliable method for determination in the variation in the population of foxes over times[9,10].

MATERIAL AND METHODS

Study Area: Present studies were conducted in Desert National Park Sanctuary, spread in the Jaisalmer and Barmer district of Rajasthan. It was declared a reserved wild life sanctuary in year 1980. However, it is yet to be recognized and given status of a National Park by the Govt. of India. It spreads over 3162 sq. km area in both of the districts. It lies at 25^0 47' to 26^0 46' in northern eclipse and 70^0 15' to 70^0 45' in eastern eclipse. The state government of Rajasthan had passed the resolution and declared entire area as a National Park in 1981. The sanctuary has been divided into a central core area and the peripheral buffer area. A total of 9727

hectares of the sanctuary has been developed into 15 core areas to minimize the human interference and it is completely banned for the livestock grazing. The core areas are protected by wire fencing. They are further sub divided into 28 enclosures. This is only sanctuary known where agricultural activities and livestock grazing are permitted in the peripheral buffer area. DNP is an important area from the point of view of conservation of biodiversity amidst the Thar Desert. It is a pre-eminent example of ecosystem of the Thar Desert due to its all the natural characters, diverse fauna and flora. The study was carried out in three different sites namely, Sudasari, Khuri and Kanoi in the DNP Sanctuary.

Direct observation technique and questionnaire[11] was used to count the number of Dens. Depths of the Dens were estimated by using iron wire or a bamboo-stick. Openings of the dens were counted by visual method. The data concerning behaviour and activities were collected from dawn to evening twilight in each season as made by Altman[11]. Information were also gathered from farmers, shepherds and local inhabitants of the Dhanies (very small human habitat consisting of merely one or two families amidst desert or crop fields).

Animals were further studied in natural environment at various study sites using direct observation technique. This observer used dull colour clothes (instead of bright coloured) while observations concerning activities of foxes were made. A prismatic field binocular (8 X 40x) was used throughout the study for direct observation on the animals. Photographs of animals were taken using a Canon camera fitted with x75-400 zoom lenses.

RESULTS AND DISCUSSION

Dens provide the shelter and protection. It has a microenvironment that is totally different from the external natural environment. Foxes prefer bushes, more particularly their basal parts or the base of an individual plant, for making their dens. It is probably the root system that provides a good mechanical support to the borrows of the den, saving from being collapsed. Maximum dens were recorded near the Dhanies due to easy availability of water and food material. Dens were noted occupied more vigorously during winters, excessive summers and, after pregnancy. During summers its use was primarily restricted to the extreme hot noons in day times so as to avoid sun strokes due to very warm winds of the desert. The peak resting period stayed between 11.00 hours to 17.00 hours. During winters dens were primarily used in the night when temperature falls to an irresistible range in the desert. The foxes also used their dens more intensively after pregnancy for rearing and safety of their pups. A female more often with all pups always stayed near its den. Whenever threats were felt, all of a sudden they disappeared from sight and rushed to den immediately. In the absence of mother, pups always remained inside the den. It was observed during the study period that desert foxes were not affected by the Phet (cyclone) because at those times they lived deep inside their dens. At all the three sites a total of 30 dens were studied. Dens had a depth ranging between approximately 3 to 10 feet. The dens found in the referred study sites had following characteristics.

At Sudasari study site 10 dens were found out of them six were in use and four were abandoned (Table 1). Most of the dens were recorded at the basal part of Ker plants. Dens found at this study site were recorded having only one opening. This is primarily because of the fact that this study site was quite protected and foxes had no threat of poachers, predators and feral dogs etc. Most of the dens were situated near the periphery of the core area fencing. There were some Dhanies immediately preceding the fencing that constituted an uninterrupted source of water and food to the foxes. Dens found in Sudasari site were nearly 3-7 feet deep.

There were 13 dens recorded at Khuri study site. Out of them seven were in use and six were abandoned. Out of them 11 had either 1 or 2 openings and 2 of them had three. Maximum 6 dens were found at the base of Ker while 3 were situated at the base of Jal, 2 at the base of Lana, one at Ber and one den was dug at the base of Kheemp plant. It was observed and concluded that those dens which had 2-3 openings were because of consistently approaching threats from poachers, predators and feral dogs etc. in this study site. Maximum number of the dens was recorded near the Dhanies. Dens found in Khuri sites were nearly 4-10 feet deep (Table 1).

In Kanoi study site, 7 dens were found, out of them three were in use and four dens were abandoned. Out of them 5 had 1 or 2 openings and 2 were found with 3 openings. Maximum 4 dens were found in the basal part of Ker while 2

dens in the base of Jal, 1 at the base of Lana plant. Dens found in Kanoi site had 1-3 openings which helped them to escape from den at the time of threat. Jogi (Tribe) hunted the Desert Fox for meat with the help of their dogs. Maximum dens were observed near the Dhanis. The depth of dens found in Kanoi sites ranged between 4-9 feet (Table 1).

Most Red Foxes live in the densely vegetated open area so that they may escape to their dens in case of bad weather and other threatening situations. The availability and use of denning sites are important aspects of the ecology of most canids and are indicative of breeding units within the habitat[12]. Habitat for denning could be a limited resource largely determined by factors such as patchiness, food availability[13], presence of conspecifics, predators [12,14,15] and, human disturbance[16]. In some Red Foxes denning is exclusively restricted to the breeding season 13 and foxes have been reported to return to their natal dens repeatedly for breeding[17]. The number of breeding dens is an important indicator of reproductive success and therefore it can be regarded as a reliable method for determination in the variation in the population of foxes over times[9, 10].

Lack of habitat protection is probably the greatest threat to the Indian Fox. For example, in southern India, less than two percent of potential Indian Fox habitat is covered under the existing protected area network of the states of Karnataka and Andhra Pradesh[18]. Hunting for its skin and flesh as well as conversion of its grassland habitat to agriculture, industry and increasingly bio-fuel plantations, have affected its population density.

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Table 1. Characteristics of the Dens of Desert Fox at the three study sites

Parameters	Study sites		
	Sudasari	Khuri	Kanoi
Total number of observed dens	10	13	7
Dens used by foxes	6	7	3
Dens unused	4	6	4
Average number of openings of each den	1	1-3	1-3
Depth range of dens	3-7 ft	4-10 ft.	4-9 ft
Names of the plants whose bases were used to construct dens	Ker (*Capparis decidua*), Jal (*Salvadora persica*), Sevan grass (*Lesiurus sindicus*)	Ker (*Capparis decidua*), Jal (*Salvadora persica*), Ber (*Ziziphus nummularia*), Lana (*Haloxylon salicornicum*), Kheemp (*Leptadenia pyrotechnica*)	Ker (*Capparis decidua*), Jal (*Salvadora persica*), Lana (*Haloxylon salicornicum*)
Average distance between two dens	1.5 -2.0 km	1.5-1.7 km.	1.5-1.7 km

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