



### Diet of the Indian fox (*Vulpes bengalensis*) in dry scrubland of north Gujarat, India

Indian fox *Vulpes bengalensis* (Fig. 1A), a mesocarnivore of the Indian subcontinent, is distributed widely in all kinds of habitats in India except the Western Ghats (Roberts 1997). The Indian fox prefers semi-arid landscapes with low rainfall where it is easy to hunt and dig dens and where the vegetation is mainly short grasslands or scrub, thorn thickets or dry deciduous forests. They mostly avoid dense forests, steep terrain, tall grasslands, and true deserts (Prater 1980, Macdonald & Sillero-Zubiri 2004). The Indian fox is listed as of Least Concern (LC) by the IUCN (Jhala 2016) and legally protected in India under schedule II of the Indian Wildlife Protection Act 1972. An opportunistic and omnivorous feeder, its diet includes insects, scorpions, centipedes, small rodents, monitor lizards and other reptiles, ground nesting birds, their eggs and fruit such as *Ziziphus* sp. (Rhamnaceae), *Citrullus vulgaris* (Cucurbitaceae), *Azadirachta indica* (Meliaceae), *Mangifera indica* (Anacardiaceae), *Syzgium cumini* (Myrtaceae), *Melia azedarach* (Meliaceae), and *Ficus bengalensis* (Moraceae) (see Prater 1980, Manakadan & Rahmani 2000, Vanak 2003, Gompper & Vanak 2006). Some local shepherds have also reported seeing Indian foxes feed on the freshly voided pellets of sheep (Johnsingh 1978). Their presence and density in any area is closely related to the abundance of food.

This study was carried out in the 1.5 km<sup>2</sup> grazing commons of Vagadipolo village, northern Gujarat (Fig. 1B). It is semi-arid scrubland with a very dry and hot climate. Vegetation is thin shrub and scattered trees. Other mammals include wild boar (*Sus scrofa*), nilgai or blue bull (*Boselaphus tragocamelus*), and feral dogs (*Canis lupus familiaris*). The present study was part of a larger study of the denning ecology of the Indian fox (December 2018 to February 2020). We averaged 10 to 12 field days in every month; the field surveys were

carried out from 0600 to 1000 h in the morning and 1500 to 1900 h in the afternoon. We searched for fox dens with the help of local shepherds. Although the study area does not have any species with similar fecal material, to avoid misidentification we collected scat mainly around the active dens of the foxes. Scats (Fig. 2A) were collected in polythene ziploc bags with details of date, time and geo-coordinates.

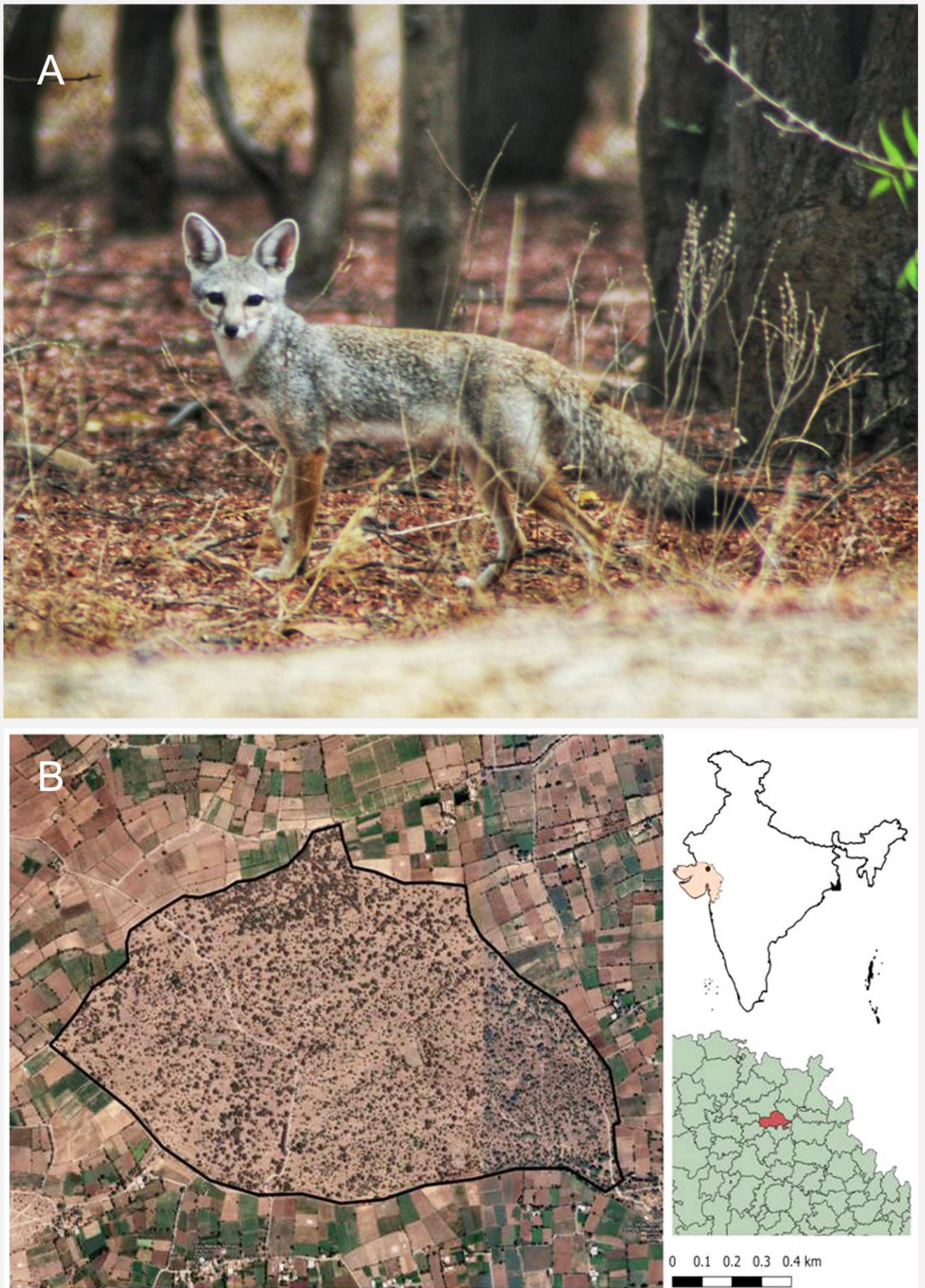
A total of 56 scats were collected from the study area. Each scat was sun-dried and then washed under running water in sieves of 25 to 35mm mesh-size. The undigested materials were again sun dried and the remains were segregated for food identification. The segregated residues were observed under dissecting microscopes to identify the food items. We found seeds of *Diospayros montana* (Ebenaceae) and *Ziziphus* sp., and parts of insects, remains of bone and hairs (Fig. 2B). This study revealed the food composition of the Indian fox on the human-dominated grazing commons (Table 1).

**Table 1.** Percentage occurrence of different food remains in scats of the Indian fox

food remains in the scats (n=56)	Season	
	Monsoon and early-winter (wet, n=36)	Late-winter and summer (dry, n=20)
Plant matter		
Seeds	11.1	26.1
Other (barks/roots /leaves)	12.5	21.7
Animal matter		
Bones	22.2	6.5
Mammals	19.4	6.5
Feathers	12.5	8.7
Arthropods	22.2	30.4

The fox, being an opportunistic and generalist feeder, was found to consume food according to the availability of fruiting species and the abundance of several arthropods in this scrubland. The seasonal variation that we found agreed with previous studies of feeding habits (Home 2005). During the monsoon and early-winter, residues of *D. montana* and *Ziziphus* sp. were more frequent, compared to other food

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**Figure 1.** (A) An Indian fox (*Vulpes bengalensis*) sighted in the study area (B) the study area of dry scrubland in Vagadipolo, northern Gujarat, India

items in the scats. The occurrence of *D. montana* seeds in Indian fox scats has not been previously reported. Six of the 56 scats that we collected contained the seeds of *D. montana* along with *Ziziphus* seeds. We also noticed a high density of *D. montana* plants in the study area in winter. During late-winter and summer, we found more animal matter such as bones, hair and arthropod body parts. The simple Chi-square test shows that there is significant difference between the consumption of animal matter in the wet season and plant matter in the dry season ( $n=56$ ,  $\chi^2=21.1$ ,  $p=0.0008$ ). Overall, we found arthropods to be a major diet item of the Indian fox, which is similar to previous studies (Vanak 2003, Home 2005, Dookia *et al.* 2012). However, birds were not reported in the study conducted by Home (2005). During the monsoon and early-winter, the Indian fox becomes more frugivorous due to the high availability of fruit, as is also reported for the red fox, *Vulpes vulpes* (Cavallini & Lovari 1991). This study also showed that the diet of omnivorous and generalist animals may have some relationship with meteorological factors, which might be useful as an indicator of climate change if studied for longer periods of time.



**Figure 2.** (A) Scats and (B) prey remains of Indian fox in the study area: (1) hair and seeds of (2) *Diospyros montana* and (3) *Ziziphus* sp.; scale: 1 cm.

### Acknowledgements

We thank WCB Research lab, HNG University for providing facilities; S. Patel and S. Mesaria

for valuable comments; and S. Chaudhary and N. Rabari for the support in data collection.

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Submitted: 23 Nov 2021, Accepted: 21 March 2022  
Section Editor: Lee Harding

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