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FEEDING HABITS OF THE RED FOX (*VULPES VULPES*) IN THE DJURDJURA REGION, NORTHERN ALGERIA

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Abstract. This study investigated the diet of the red fox (*Vulpes vulpes*) in a mountain ecosystem (Djurdjura National Park), with a particular focus on potential seasonal variation. A total of 360 fecal samples collected over a full year yielded 1051 food items, which were classified into ten trophic categories. Analyses indicated a highly heterogeneous diet, reflecting the species' generalist and opportunistic foraging strategy. Mammals constituted the primary food source, followed by plants and arthropods. The wood mouse (*Apodemus sylvaticus*) emerged as the predominant prey throughout the year, likely due to its high availability and/or a strong predatory preference. Seasonal dietary shifts were evident with plant consumption increasing during the dry season, while mammalian prey became more prominent during the rainy season.

INTRODUCTION

The red fox (*Vulpes vulpes*) is the most widely distributed terrestrial carnivore, with an estimated range of approximately 64.7 million km² across Eurasia and North America (Schipper et al. 2008). Among canids, it is the only species recorded on five continents and in a total of 83 countries, highlighting its exceptional adaptability to diverse habitats (Sillero-Zubiri et al. 2004). The species is found across Europe, Asia, North America and North Africa (Cuzin 2003). It was introduced to Australia in 1868 and has since spread extensively across the continent (Larivière and Pasitschniak-Arts 1996). In Africa, the red fox inhabits northern Maghreb, north-western Libya and the Nile valley from Cairo to northern Sudan (Triplet 2009). In Algeria, *Vulpes vulpes* is distributed across coastal regions and the high plateaus extending to the Saharan Atlas (Kowalski and Rzebik-Kowalska 1991).

The remarkable geographical extent of this species testifies to its great ecological plasticity, allowing it to exploit an impressive diversity of environments, ranging from tundra to desert, passing through temperate forests, agricultural lands and peri-urban areas (Larivière and Pasitschniak-Arts 1996; Henry 2004; Aulagnier et al. 2020). This adaptability reflects the flexibility of its ecological niche, shaped by its tolerance to varied abiotic conditions and dietary versatility.

Indeed, the occupation of a wide diversity of biotopes is accompanied by a great diet plasticity. As a generalist and opportunist, the red fox adjusts its food preferences according to local and seasonal availability (Dell'Arte and Leonardi 2005; Castaneda et al. 2022). It preys on a wide range of food, including mainly small mammals, birds, invertebrates, plants and waste (Fedriani 1996; Lanszki and Heltai 2002; Padial et al. 2002; Stuart and Stuart 2003; Henry 2004; Lenaina et al. 2004; Sillero-Zubiri et al. 2004; Dell'Arte et al. 2007; Aulagnier et al. 2020; Lanszki and Heltai 2010; Bassi et al. 2012; Barrull et al. 2014; Castaneda et al. 2022).

In addition to its dietary flexibility, the red fox is distinguished by a great variability in its spatial, social, and reproductive behaviour (Henry 2004). The size of population and its home range are influenced by the distribution of key resources like food and shelter, their availability and their spatio-temporal variation (Baker et al. 2000).

Although the typical social unit is a monogamous pair, it can range from a solitary individual to a group of up to ten individuals (Henry 2004). This social structuring

model reflects the adaptability of the species to diverse ecological and anthropogenic contexts.

The red fox (*Vulpes vulpes*) is a valuable model for investigating food availability and prey diversity within a given area due to its marked dietary flexibility and capacity to exploit a wide range of habitats and food sources. In North Africa, studies on the feeding ecology of this species remain limited and mostly restricted to steppe, arid or insular environments (Basuony et al. 2005; Dell'Arte and Leonardi 2005; Karssene et al. 2019). Little is known about its diet in forested mountain ecosystems, where prey availability and human influence differ considerably. The present study was therefore undertaken to fill this gap by characterizing, for the first time the diet of *Vulpes vulpes* in the Djurdjura forest (northern Algeria) throughout the year. Specifically, we aimed to (i) identify the dominant food items, (ii) assess seasonal changes in diet composition, and (iii) compare the results with dietary patterns reported elsewhere across the species' distribution range.

MATERIALS AND METHODS

Study area

This study was conducted in the Darna forest massif, a site situated on the northern slopes of the Djurdjura National Park. The study area is located to the southeast of the Wilaya of Tizi Ouzou (Kabylia, Algeria) and extends between the following lumbar coordinates: 36°28'–36°30' north latitude and 04°15'–04°17' east longitude. The area's climate is classified as a humid Mediterranean climate with temperate winters, which has allowed a wide variety of vegetation to develop.

The main plant species in this region is the green oak (*Quercus ilex*), which forms an oak grove with a cover of between 60 and 80%. This species is frequently associated with other forestry species, including Montpellier maple (*Acer monspessulanum*), narrow-leaved ash (*Fraxinus angustifolia*), elm (*Ulmus campestris*), wild cherry (*Prunus avium*) and cedar (*Cedrus atlantica*).

The density of the undergrowth shows variation from one location to another, contingent upon altitude, exposure, and human influence (trampling by domestic animals). It is predominantly characterized by lentisk (*Pistacia lentiscus*), tree heath (*Erica arborea*), flax-leaved daphne (*Daphne gnidium*), Spanish broom (*Spartium junceum*), spiny broom (*Calycotum spinosa*), rosewood (*Rosa* sp.) and phillyrea (*Phillyrea* sp.).

The herbaceous layer is characterized by a seasonal presence, being almost absent in winter and very important in spring. The herbaceous layer is dominated by a diverse array of species, including but not limited to: African cyclamen (*Cyclamen africanum*), plantain (*Plantago* sp.), dandelion (*Taraxacum* sp.) and numerous others.

The study area is characterized by remarkable biodiversity reflected in a rich and varied fauna that includes mammals such as the Barbary macaque (*Macaca sylvanus*), wild boar (*Sus scrofa*) and red fox (*Vulpes vulpes*), along with numerous species of small mammals, birds, reptiles, amphibians, and invertebrates. This description provides a general overview of the local fauna and illustrates the ecological diversity of the region.

Study method

The study of the diet of the red fox (*Vulpes vulpes*) was based on the analysis of 360 faecal samples collected regularly over the course of a year. The results obtained were pooled into three-month periods corresponding to the four seasons of the Mediterranean climate. The samples were collected along paths and tracks marked by the presence of the red fox. The shape, length, diameter and place of deposition of the droppings are now key characteristics in distinguishing red fox droppings from those of other sympatric carnivores.

In the laboratory, samples are processed using the dry method protocol. This protocol has been described by several authors (Ruiz-Olmo and Lopez-Martin 1993; Santos et al. 2007; Lanszki et al. 2016, 2020).

The faeces were then subjected to a sterilization process in an oven at a temperature of 120° C for duration of one hour, with the objective of eliminating any potential risk of contamination by pathogenic germs. Subsequently, the faeces were immersed in water for a period of 24 hours, after which they were washed under a jet of water through a 0.5 mm mesh sieve, with the purpose of removing the faecal matter and recovering the undigested solid food. The residues obtained were then spread out on paper and air-dried for 24 to 48 hours. Finally, the undigested fragments (hair, bone, plant material, insect fragments, etc.) were sorted separately into Petri dishes for identification. The diet was categorized into ten food groups: mammals, arthropods, wild birds, domestic birds, energy plants (fruits and berries), non-energy plants (grass leaves), snails, eggs, reptiles and waste. The identification of items was based on several determination keys and reference collections. The key of Debrot et al. (1982) was used to identify mammalian hairs. Bone remains and teeth were also examined and identified using the key of Erome and Aulagnier (1982), thereby confirming the results of the hair analysis.

Data analysis

A series of measurements and analyses were conducted utilizing statistical tools to assess variation in the red fox's diet and to facilitate a comparison with previous studies:

Table 1. Digestibility coefficients for different food categories.

Food categories	Digestibility coefficients
Small mammals	23 (a), (b), (c)
Lagomorphs	50 (a)
Medium-sized mammals	50 (c)
Wild boar and domestic ungulates	118 (c), (e)
Reptiles	18 (c)
Arthropods	5 (a), (b), (c)
Molluscs	5 (a)
Birds	35 (c)
plants	(a), (b), (c)
Eggs	(d)

(a): Santos et al. (2007), (b): Carvalho and Gomes (2001), (c): Lanszki and Heltai (2002), (d): Webbon et al. (2006), (e): Goszczyński (1974).

- Frequency of occurrence (FO) refers to the percentage of faeces containing a particular item.
- Relative frequency (RF) is the proportion of a specific item among all recorded items.
- Percentage of biomass removed (PB) is calculated by multiplying the prey's dry weight by its digestibility coefficient.

The coefficients used are listed in Table 1. Trophic categories lacking digestibility coefficients, such as waste, were excluded from this analysis.

To assess the dietary diversity of the red fox, two ecological indices were used:

- The Shannon's diversity index: $H' = -\Sigma P_i \log_2 P_i$, where P_i is the relative frequency of each food category.
- The equitability index: $J' = H' / H_{max}$, where $H_{max} = \log_2 S$ where S is the total number of food categories.

The equitability index varies between 0 and 1 depending on the degree of specialization of the diet. Values close to 1 indicate a generalist tendency, while values close to 0 indicate a specialist tendency (Ramade 1994).

These two indices are relative measures and should be interpreted within the context of the study, taking into account factors such as food resource availability (Legendre and Legendre 1998).

Finally, to highlight any seasonal variations in the items ingested, the Chi-squared test of independence was performed using the R software (R Core Team 2023).

RESULTS

Global spectrum

A detailed analysis of 360 faecal samples revealed a total of 1051 food items classified into ten dietary categories (Table 2). Mammals dominated the diet, accounting for 31.3% of item frequency and 59.73% of total ingested biomass. They were followed by energy plants, arthropods, non-energy plants and wild birds. The remaining food categories, including waste, eggs, domestic birds, gastropods, and reptiles, were all recorded at low frequencies, each contributing less than 5% to the overall diet.

The mammalian prey included 14 species, with rodents making up the majority (FO = 74.16%; PB = 32.59%). The wood mouse (*Apodemus sylvaticus*) and the wild mouse (*Mus spretus*) were the most frequently consumed, with frequencies of 48.33% and 16.39%, and biomass contributions of 18.91% and 7.04%, respectively. An exception was the artiodactyls (sheep and wild boar), which, despite a low frequency of occurrence (FO = 6.11%), accounted for a considerable share of the biomass (PB = 18.27%) (Table 2).

Seasonal variations

The Chi-squared test indicates a strong seasonal effect on the red fox's diet composition (χ^2 = 119.38; df = 27; p = 1.388e-13).

Mammal consumption peaked in winter and autumn, with a moderate decline during spring and summer. Energy plants and arthropods were primarily consumed in summer and autumn, while non-energy plants were more prevalent in spring. The analysis further revealed that predation on birds also shows a seasonal contrast, peaking in spring and autumn for wild birds, and in winter for domestic birds (Figure 1).

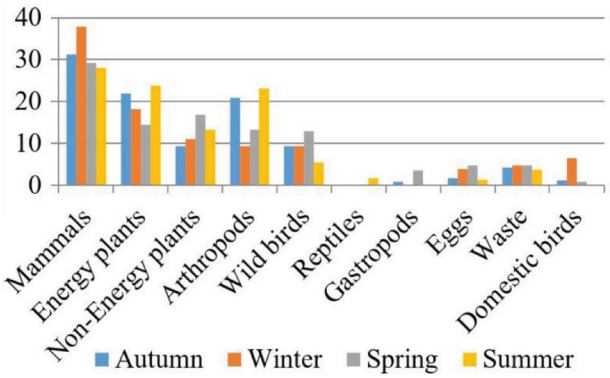

Figure 1. Seasonal variation (RF%) of food categories in the red fox diet in Darna forest (Djurdjura National Park).

In the case of mammals, seasonal variations have a significant impact on the species that are hunted (χ^2 = 58.975; df = 39; p = 0.02097). As shown in Figure 2, the wood mouse (*Apodemus sylvaticus*) was the most prevalent prey species across all seasons, with a notable increase in abundance during spring. In contrast, the wild mouse (*Mus spretus*) and the brown hare (*Lepus capensis*) were consumed more frequently during summer, while wild boar (*Sus scrofa*), Barbary macaque (*Macaca sylvanus*) and sheep peak in winter.

Table 2. RF, FO and PB of the different trophic categories in the red fox's diet in the Darna forest (Djurdjura National Park).

Categories		Items	N	RF %	FO %	PB %
Mammals		*Apodemus sylvaticus*	174	16.56	48.33	18.91
		Mus spretus	59	5.61	16.39	7.04
		Mus musculus	12	1.14	3.33	1.47
		Eliomys quercinus	10	0.95	2.78	1.39
		Hystrix cristata	7	0.67	1.94	2.52
		Rattus rattus	5	0.47	1.39	1.28
	Rodents		267	25.40	74.16	32.59
		Lepus capensis	14	1.33	3.89	3.84
	Lagomorphs		14	1.33	3.89	3.84
		Crocidura russula	5	0.48	1.39	0.38
		Suncus etruscus	2	0.19	0.55	0.11
	Insectivores		7	0.66	1.94	0.49
		Herpestes ichneumon	6	0.57	1.67	1.94
		Mustela nivalis	2	0.19	0.55	0.15
	Carnivores		8	0.76	2.22	2.09
		Sus scrofa	14	1.33	3.89	11.48
		Ovis aries	8	0.76	2.22	6.79
	Artiodactyls		22	2.09	6.11	18.27
		Macaca sylvanus	11	1.05	3.05	2.46
	Primates		11	1.05	3.05	2.46
Total Mammals			329	31.30	91.39	59.76
Plants		Moraceae	115	10.94	31.94	12.78
		Rosaceae	50	4.76	13.89	6.00
		Vitaceae	15	1.43	4.17	3.80
		Oleaceae	11	1.05	3.05	4.12
		Solanaceae	16	1.52	4.44	0.53
	Energy plants		207	19.70	57.49	27.23
		Poaceae	132	12.56	36.67	7.73
	Non-energy plants		132	12.56	36.67	7.73
Total plants			339	32.26	94.16	34.96
Arthropods		Scarabeidae	88	8.37	24.44	0.21
		Acrididae	59	5.61	16.39	0.15
		Buthidae	4	0.38	1.11	0.01
		Mantidae	5	0.47	1.39	0.01
		Carabidae	22	2.09	6.11	0.11
Total Arthropods			178	16.92	49.44	0.48
Birds		Wild birds	95	9.04	26.39	3.02
		Domestic birds	20	1.9	5.56	1.36
Total birds			115	10.94	31.94	4.38
Eggs			29	2.76	8.05	0.27
Gastropods			11	1.05	3.05	0.13
Reptiles			5	0.47	1.39	0.04
Waste (plastic, textiles, aluminum)			45	4.28	12.5	-

N: number of items, FO: frequency of occurrence, RF: relative frequency, PB: percentage of biomass.

The consumption of plants was significantly influenced by seasonal variations (χ^2 = 84.007; df = 15; p = 1.283e-11). As illustrated in Figure 3, the consumption of non-energy plants, particularly Poaceae, were consumed throughout the year, with the lowest frequency in autumn (FR = 29.63%) and the highest in spring (FR = 53.73%). Moraceae (*Ficus carica*) were predominant in autumn (FR = 49.38%) and winter (FR = 50.72%), while Rosaceae (cherries and wild cherries) were mostly consumed in summer (29.36%) and to a lesser extent in spring (18.75%). The remaining plant families appeared only sporadically in the diet and never exceeded 8.26% in any season.

Seasonal variations among arthropods were significant (χ^2 = 68.173; df = 12; p = 7.027e-10). Scarabaeidae and Acrididae were the most frequently consumed families, with peaks of 70.59% in spring and 72.22% in autumn, respectively. Carabidae were present through-

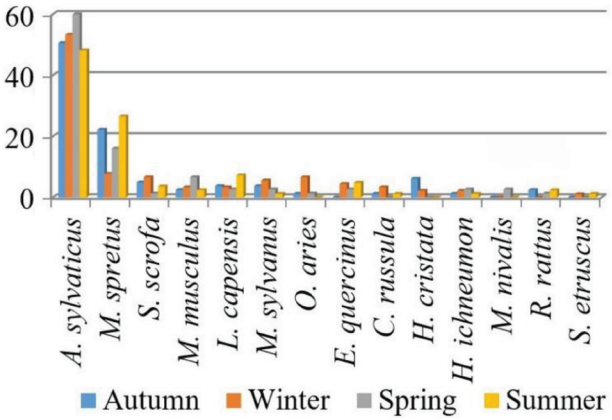

Figure 2. Seasonal variations (RF%) in the red fox mammalian prey in the Darna forest (Djurdjura National Park).

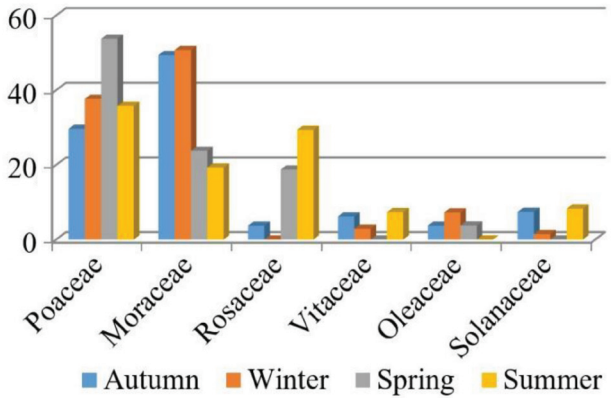

Figure 3. Seasonal variations (RF%) of plants in the red fox diet in the Darna forest (Djurdjura National Park).

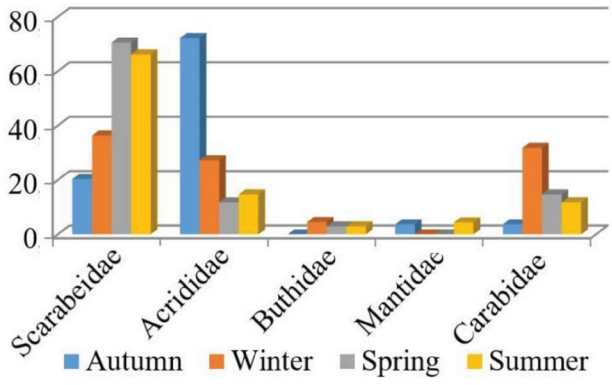

Figure 4. Seasonal variations (RF%) in the red fox arthropod prey in the Darna forest (Djurdjura National Park).

Table 3. Shannon index (H') and equitability index (J') of the red fox's diet in the Darna forest (Djurdjura National Park).

Index	Global diet	Seasonal diet			
		Autumn	Winter	Spring	Summer
H' (bits)	4.05	3.80	3.88	3.72	3.86
H max (bits)	4.95	4.70	4.64	4.58	4.64
$J' = H'/H$ max	0.82	0.81	0.84	0.81	0.83

out the year, reaching their highest frequency in winter (31.82%) and the lowest in autumn (3.70%). Other arthropod families, such as Buthidae and Mantidae, were consumed in minimal amounts throughout the year (Figure 4).

Trophic diversity

The Shannon diversity index (H') and the equitability index (J') presented in Table 3 indicate that the red fox maintains a high and relatively stable trophic diversity throughout the year. H' values range from 3.72 to 3.88 across seasons, showing little seasonal variation. At the same time, the equitability values (J') remain consistently high (between 0.81 and 0.84), reflecting a balanced distribution of dietary resources. Together, these results support the generalist feeding strategy of the species.

DISCUSSION

Global spectrum

A wide range of both animal and plant prey was consumed by the red fox in the Darna forest, with most prey categories available in the area represented in its diet. These results confirm that the red fox is a generalist and opportunistic predator, a pattern consistently observed in various localities across its distribution range (Carvalho and Gomes 2001; Padial et al. 2002; Lenaina et al. 2004; Sillero-Zubiri et al. 2004; Dell'Arte and Leonardi 2005; Lanszki et al. 2006; Sidorovich et al. 2006; Dell'Arte et al. 2007; Rosalino and Santos-Reis 2009; Bassi et al. 2012; Bakaloudis et al. 2015; Fleming et al. 2021). Additionally, this study provides the first detailed dietary data from northern Algeria, highlighting its capacity to adjust feeding habits according to local resource availability.

The environmental heterogeneity of the Darna forest provides the red fox with access to a wide variety of mammalian prey, represented by 14 species, constituting its primary energy source. Most of these mammals are rodents, a pattern consistent with the findings of numerous studies on the trophic ecology of the species across its distribution range: Serafini and Lovari (1993) in Italy, Lanszki et al. (1999, 2006, 2020) in Hungary, Carvalho and Gomes (2001) in Portugal, Padial et al. (2002) in Spain, Stuart and Stuart (2003) in the United Arab Emirates, Dell'Arte and Leonardi (2005) in Tunisia, Santos et al. (2007) in Portugal, Jankowiak and Tryjanowski (2013) in Poland, and Bakaloudis et al. (2015) in Greece.

This reliance on rodents is well documented and reflects a close relationship between prey availability and predator diet. As observed by Moreno-Rueda and Pizarro (2010) in Spain, rodents play a central role in the diet of carnivores, with a positive correlation between rodent abundance and the density of their predators. Similarly,

Carvalho and Gomes (2001) observed that in Portugal, a high proportion of rodents in the red fox's diet was closely linked to their local abundance. This pattern is also evident in our study area where prey availability appears to strongly influence fox feeding behaviour, as also noted by Castaneda et al. (2022). Among the rodents, the wood mouse (*Apodemus sylvaticus*) stands out as the most common species and the primary contributor to the red fox's energy intake. This predominance likely results from its high abundance in the area, as the forest habitat of the Djurdjura represents an ideal environment for this species (Hamdine and Poitevin 1994; Khidas et al. 1999). Moreover, the wood mouse is also a major prey item for the common genet (*Genetta genetta*) at the same site, where it accounts for up to 80% of its diet (Amroun et al. 2014b). The fox's diet is further diversified by the inclusion of other rodent species, such as the wild mouse (*Mus spretus*) and the house mouse (*Mus musculus*).

Beyond rodents, other mammalian preys also contribute significantly to the red fox's diet. In particular, the data further indicate that the biomass of artiodactyls (wild boar and sheep) remains high (PB = 18.27%). This may reflect their high fat content, offering a rich energy source. Consuming such prey allows the red fox to meet its caloric needs more efficiently, especially during periods when smaller prey might be less abundant. This diet component likely plays an important role in sustaining the fox's metabolic demands and overall health.

Among the mammals consumed, carnivores are also present in the red fox's diet. This has been reported by Dell'Arte et al. (2007) and Bakaloudis et al. (2015), especially concerning mustelids. A relatively low frequency of such prey is likely explained by their occasional consumption, either as carrion or as weak or juvenile individuals that are easier for the red fox to catch.

In addition to mammals, the red fox's diet includes a variety of plant species belonging to different families, such as Poaceae, Moraceae, and Rosaceae, which remain important food sources throughout the year. This observation is consistent with findings reported for many carnivores living in Mediterranean regions (Rosalino and Santos-Reis 2009).

A significant presence of plant matter in the diet of this canid has also been noted by Calisti et al. (1990), Serafini and Lovari (1993), Bassi et al. (2012), and Bakaloudis et al. (2015). While some plants, such as those from the Poaceae family, do not provide calories, they serve an important purgative function by helping to eliminate hair from the digestive tract and expel ingested toxins (Sanchez et al. 2008). Moreover, these plants contribute to the daily water intake of carnivores (Amroun et al. 2014a, b).

Energy plants are primarily constituted of cultivated fruits, including cherries, figs and olives, among others. This is attributable to their prevalence within the study area, characterized by the presence of numerous orchards in the vicinity of the Darna forest. This category of food (especially Moraceae and Rosaceae) is an energy source for carnivores, providing them with additional calories at certain times of the year (Amroun et al. 2006; Rosalino and Santos-Reis 2009).

Similar to other opportunistic carnivores, the red fox consumes a considerable proportion of arthropods (FR = 16.93%). This consumption highlights the flexibility of its diet and its capacity to adjust feeding habits based on local prey availability. The findings of this study align with those reported in previous research, including the works of Serafini and Lovari (1993), Fedriani (1996), Bassi et al. (2012), and Jankowiak and Tryjanowski (2013).

However, despite their low energy content (BP = 0.48%), arthropods may serve other functional roles in the fox's diet. One possible explanation for their significant consumption is the presence of chitin, which makes up the exoskeleton of arthropods and is believed to facilitate digestive processes by promoting intestinal transit and aiding in the elimination of indigestible material (Amroun 2005). Within this category, beetles (Coleoptera), particularly from the Scarabaeidae and Carabidae families, are the most frequently represented. This observation is consistent with the findings of Calisti et al. (1990) in Italy and Dell'Arte and Leonardi (2005) in Tunisia. Their prevalence in the diet may be explained by their ease of capture and their continuous availability throughout the year.

Finally, the diet of the red fox also reflects its ability to exploit anthropogenic resources. Indeed, the presence of domestic animals such as poultry (*Gallus* sp.) and sheep (*Ovis aries*), cultivated fruits, and household waste in its diet further confirms its opportunistic feeding behaviour and its ability to exploit anthropogenic resources (Castaneda et al. 2022). This highlights the species' strong capacity to adapt to anthropization processes, showing a clear tendency to approach human-influenced environments in search of food.

In summary, the red fox in the Darna forest exhibits a highly flexible and opportunistic feeding strategy, consuming a diverse range of animal and plant prey. Its diet is mainly composed of mammals, particularly rodents, supplemented by plants, arthropods, and anthropogenic resources. This dietary diversity highlights the species' broad trophic niche and its plasticity, reflecting its ability to adapt to a heterogeneous environment.

Seasonal variations

The present study investigates the trophic spectrum of the red fox (*Vulpes vulpes*) in relation to the seasons in the Djurdjura region, emphasizing the dynamic nature of

its trophic niche, with a view to elucidating its feeding strategies and habits. Seasonal changes further illustrate the fox's feeding adaptability beyond its overall diet composition. This analysis provides insight into how the species adapts its foraging behaviour to environmental fluctuations specific to this mountainous area. Accordingly, the diet of this carnivore exhibits seasonal variations, with an increase in the proportion of plants during dry periods and mammals during wet periods. These seasonal shifts are consistent with findings reported by Serafini and Lovari (1993), Baltrunaite (2002), Basuony et al. (2005), and Lanszki et al. (2020).

Notably, mammals are predominant throughout the year, with a marked increase in winter, which may be attributed to the high energy requirements of the red fox to survive the harsh climatic conditions that characterize this season. Among these mammals, rodents, especially the wood mouse (*Apodemus sylvaticus*), are the preferred prey throughout the year. However, other groups of mammals, chiefly artiodactyls (*Sus scrofa* and *Ovis aries*) and primates (*Macaca sylvanus*), are hunted principally in winter, a period when extreme weather conditions can compromise the survival of juveniles and the weak.

Similarly, the consumption of fruits demonstrates highly significant seasonal variations, corresponding to their availability in the environment and their respective fruiting periods. The presence of a significant proportion of *Ficus carica* outside the typical fruiting period, namely in winter, can be attributed to two potential factors: i) the accumulation of food reserves by the fox, as previously identified by Macdonald (1976), and ii) the consumption of prey (e.g. wood mouse) that has previously ingested this fruit.

The diet of *Vulpes vulpes* shows notable seasonal variations, with arthropods being a prominent component throughout the annual cycle. Specifically, a paucity of arthropods is observed in winter, corresponding to the latent period for most species, while a peak occurs in summer. The analysis further reveals that Coleoptera (Scarabaeidae and Carabidae) dominate throughout the year, except in autumn when Orthoptera (Acrididae) prevail, coinciding with their peak activity period.

Finally, the Shannon diversity index applied for the different trophic categories consumed during the study period was quite high. This shows that the species has a varied diet and that food resources are available in the study area. In addition, the equitability values close to 1 indicate that the different food items are fairly evenly consumed, confirming the predator's generalist feeding habits. This means that the red fox does not focus on specific species but adjusts its diet based on what is available in its environment. These findings confirm the red fox's broad trophic niche and illustrate how this species adjusts its foraging strategy in response to both natural seasonality and anthropogenic pressures.

CONCLUSION

The study of the diet and seasonal patterns of the red fox (*Vulpes vulpes*) has highlighted its eclectic, generalist and opportunistic nature, which illustrates its remarkable adaptability to variations in trophic availability, thus allowing it to exploit a wide range of environments. This behavioural flexibility contributes to the species' success across diverse habitats, including both natural and human-modified landscapes.

Additionally, exploring trophic interactions between the red fox and other predators, such as the African golden wolf, would provide valuable insights into interspecific dynamics and their influence on the local community structure. To deepen our understanding of the red fox's ecological role, it is recommended that a more detailed multi-year study be conducted to assess its response to environmental changes, with a focus on its trophic niche, interactions with prey populations, and potential influence on ecological balance.

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