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WINTER DIET OF THE COMMON GENET, *GENETTA GENETTA* (CARNIVORA, VIVERRIDAE), AND THE AFRICAN GOLDEN WOLF, *CANIS ANTHUS* (CARNIVORA, CANIDAE), IN ALTITUDINAL LOCALITY OF THE EDOUGH FOREST (NORTHEASTERN ALGERIA)

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Winter Diet of the Common Genet, *Genetta genetta* (Carnivora, Viveridae), and the African Golden Wolf, *Canis anthus* (Carnivora, Canidae), in Altitudinal Locality of the Edough Forest (Northeastern Algeria). Boukheroufa, M., Sakraoui, F., Belbel, F., Sakraoui, R. — The understanding of several interactions between carnivores is very important to plan effective programs of conservation. In this study, we tested the hypothesis of interspecific competition when trophic resources are the most limited by comparing the diets of the african golden wolf and the common genet in winter period, and in altitudinal locality on Edough mountain. To achieve this goal, a total of 60 scat samples were collected from the study area. We were able to identify four food categories for genets (arthropods, small mammals, birds and plants) and six food categories in the diet of african golden wolf (arthropods, small mammals, large mammals, birds, fruits and anthropogenic wastes). Our results showed a significant variation in the diets between the species, more than 50 % of diets consist of fruits and large mammals for the African golden wolf, and small mammals and birds for the Common Genet. Prey category richness was highest for the African golden wolf than for genets. The trophic niche overlap was partial between the two predators (Pianka's overlap index = 0.688). All these results probably reflect a compromise in use of resources in order to minimize the competitive pressure between the two predators.
Key words: sympatric carnivores, comparative analysis, trophic niche overlap, winter period, Edough moutain.

Introduction

Empirical works showed that predator mammals are bio indicators of the state of health of the ecosystems (Wilson and Reeders, 1993). However, following the extinction or near-extinction of large predators in North Africa such as the cheetah, leopard and atlas lion, the trophic competition' level between the remaining species (the mesopredators) have been altered. This alteration has threatened the survival of some species, particularly viverridsand small canids, considered among the most vulnerable to competition (Aulagnier, 1992; Caro and Stoner, 2003; Naves et al., 2003; Dalerum et al., 2009). This trophic downgrading could have tragic consequences on the ecosystem's balance. Therefore, it is clear that studies on predation and competition behavior in these

mesopredators, through the analysis of their diets, are necessary to change the management and conservation methods that concern them (Klare et al., 2010). In this context, we looked at the diet of two mesopredators, namely the African golden wolf (*Canis anthus* F. Cuvier, 1820 (Carnivora, Canidae)) and the common genet, (*Genetta genetta* Linnaeus, 1758 (Carnivora,Viverridae)). Formerly considered at the golden jackal (*Canis aureus*), the African golden wolf saw his taxonomic classification improved due to genetic works (Gaubert et al., 2012; Bahlk, 2015; Koepfli et al., 2015) which demonstrated that he was nearer to the grey wolf (*Canis lupus*) and the coyote (*Canis latrans*) than Eurasian golden jackal (*Canis aureus*). In Algeria, few studies on the diet of this species have been conducted, mainly in the central and western parts of the country (Oubellil, 2010, Amroun et al., 2006, Eddine et al., 2017). The diet of *Genetta genetta* has been studied, particularly in Kabylie (De Smet and Hamdine, 1988; Hamdine et al., 1993; Amroun et al., 2014) and in the National Park of El Kala (Delibes et al., 1989; Boukheroufa et al., 2009). We therefore conducted a comparative analysis of the diet of these two sympatric mesopredators during the winter period and at high altitude, where the trophic resources of the environment are the most limited. The objective of this approach is to appreciate the competitive pressure between the two predators.

Material and methods

Study area

This study was carried out from the beginning of December 2016 to the end of February 2017, in Berouaga, located at 700 m of altitude in the Edough Mountain (36°54' N and 7°37' E; Northeast Algeria) (fig. 1). The dominant formations in this locality consist mainly of cork oak (*Quercus suber*) and zeen oak (*Quercus faginea*). The *Quercus faginae* forest has under developed undergrowth, and is characterized by the presence of *Cytisus triflorus*, *Rubus ulmifolius*, *Rosa canina*, *Crataegus monogyna*. *Hedera helix* and *Smilax aspera* are also very present (Boudy, 1952).

Methodology

In Berouaga locality, we selected 3 transects given the more uniform nature. For each transect, we walked 2 kms once per week. At the end of winter period, 60 scat samples were collected (30 for each predator). The distinction between predator's scats is essentially based on odor, morphometric characteristics and location of scat deposits (Bang and Dahlström, 1991; Davidson et al., 2002; Chazel and Chazel, 2008). For genets, the droppings, easily recognizable, are most often deposited in height on rocky escarpments and measured on average 13.1 ± 1.5 mm of diameter, and 138.6 ± 23.4 mm of length (Roeder, 1980, Lozé, 1984; Livet and Roeder, 1987). The differentiation of African golden wolf scats from those of other carnivores living in the same area, such as red fox (*Vulpes vulpes*), Egyptian mongoose (*Herpestes ichneumon*), wild cat (*Felis lybica*), and especially domestic dogs (*Canis lupus familiaris*) are based on specific characteristics such as the smell, size, shape and place of deposits (Macdonald, 1980; Bang and Dahlström, 1991). Our identification is also based on all signs of presence of the African golden wolf (howling, footprints, direct observations, observations of local residents), and the fact that our study site is in the forest, away from farms and residential areas, which explains why the presence of domestic dogs is rare (fig. 2).

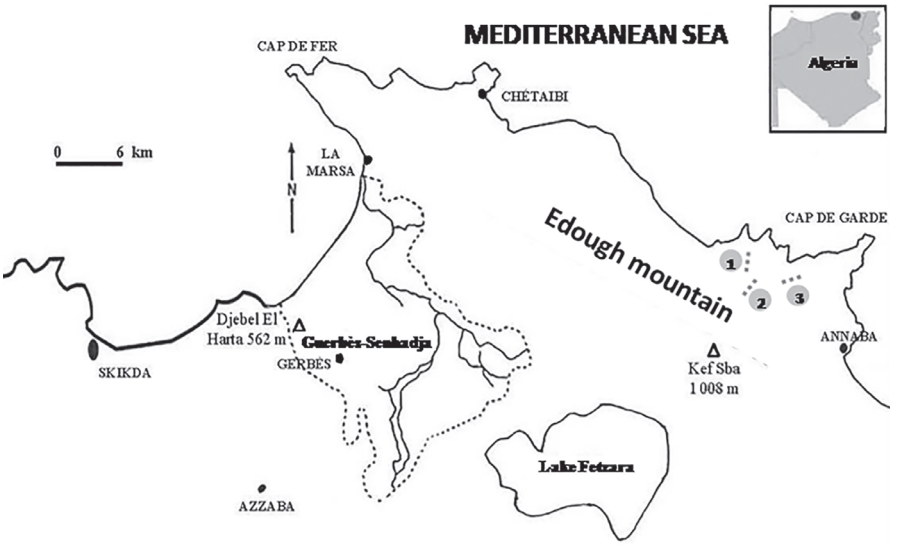

Fig. 1. Geographical situation of the study locality. (with indication of the three transects: 1, 2 and 3). Source: https://journals.openedition.org/physio-geo/docannexe/image/4217/img-1.jpg. Modified by Boukheroufa (present work).

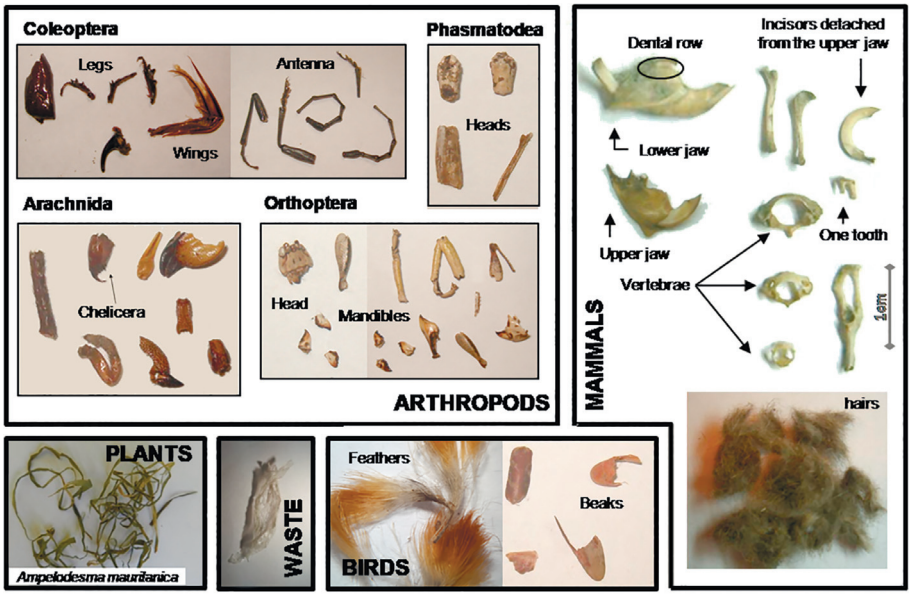

Fig. 2. All food categories consumed by the two predators (©: M. Boukheroufa).

Once collected, scats were dried (80° C in an oven for 24 hours), weighed and then dilacerated in an aqueous medium. The droppings are washed with hot water and detergent over a 0.25 mm diameter mesh screen and dried for 24 to 36 hours at a temperature of 50° C (Hamdine et al., 1993). The remains of items prey were sorted and classified into six categories: (Arthropods, small mammals such as rodents, Large Mammals such as wild boars (Boumendjel et al., 2016), Plants, Birds and anthropogenic waste).

Taxonomic order identification of mammalian preys was based on using different identification keys (Saint-Girons, Petters, 1965; Day, 1966; Chaline et al., 1974; Debrot et al., 1982). Birds were identified by using the keys of Day (1966). Plants and seeds were identified by comparison with botanical collection available in the laboratory of Soil and Sustainable Development (University of Badji Mokhtar Annaba).Arthropods were also identified by comparing these different fragments with a reference collection of Arthropods taken from the field during our study.

Data analysis

All results are illustrated in Microsoft Office Excel by histograms and sectors. The analysis of the diet was carried out by calculating the occurrence frequency or the presence index (Pi) expressed by the number of appearance of a food category on the total number of scats. This parameter was then converted to a percentage for a better reading of results. We used PAST software, version 3.25 (Hammer et al., 2001) for calculation and analysis of diet diversity of the predators: the Shannon-Weaver diversity index, calculated on the basis of natural logarithm (ln), ($H' = -\sum_{i=1}^{S} p_i \ln p_i$) and the diversity permutation test to compare the difference of the Shannon index diversities.

We calculated the Pielou's evenness index ($J' = H'/H_{max}$), where H_{max} represents the maximum diversity (H_{max} = ln S), and S the total number of food categories ingested. We also calculated the degree of feeding overlap of the two predators, based on the presence index (Pi) of the food categories, according to the Pianka's index (Pianka, 1973), described by the equation:

$$O_{jk} = \frac{\sum_{i}^{n} P_{ij} P_{ik}}{\sqrt{\sum_{i}^{n} p_{ij}^2 p_{ik}^2}}$$

Where O_{jk} = measure of Pianka's niche overlap between the species j and k; P_{ij} = proportion of food category i in the diet of species j; P_{ik}= proportion of food category i in the diet of species k; n = total number of food categories. This index assumes that prey are equally available to all predators (Reinthal, 1990). The overlap values range from 0 (no overlap) to 1 (complete overlap).

Results

Taxonomic identification

From scats, we identified 4 food categories in the diet of genet (arthropods, small mammals, birds and plants) and 6 food categories in the diet of African golden wolf (arthropods, small mammals, large mammals, birds, fruits and wastes) (table 1; fig. 2).

T a b l e 1. Diet items of the African Golden Wolf (*Canis anthus*) and the Common Genet (*Genetta genetta*)

Food items		African gloden wolf	Common genet
Small mammals	Rodents	X	X
Large mammals	*Sus scrofa*	X	–
Birds	*Erithacus rubecula*	X	X
	Others	X	X
Arthropods	Coleoptera	X	X
	Orthoptera	–	X
	Phasmatodea	–	X
	Arachnida	–	X
Plants and fruits	*Myrtus communis*	X	X
	Castanea sativa	X	X
	Rubus ulmifolius	X	X
	Ampelodesma mauritanica	X	X
Wastes	Paper and plastic	X	–

Depending on the size, we identified two categories of mammals. Small mammals consumed by genets and wolfs, which were identified from jaws, molars, incisors, fine hairs and various small bones (shins, ulna, vertebrae, etc). All these items allowed us to identify the taxonomic order of rodents. We also identified large mammals, only consumed by wolfs, by the presence of thick black hairs and large bone fragments, which indicate the presence of wild boar (*Sus scrofa*) in the diet. For bird's identification, the presence of feathers, beaks, legs and claws in scats allowed us to conclude that this group is present in diet. The frequent presence of red feathers suggests that it is the European robin (*Erithacus rubecula*), very abundant during this period (personal observations). We also identified four taxonomic orders of Arthropods: Coleoptera, Orthoptera, Phasmatodea and Arachnida. Plants and fruits are also identified in the scats, by the presence of seeds of Myrts (*Myrtus communis*), Chestnuts (*Castanea sativa*), wild blackberries (*Rubus ulmifolius*) and debris of fine and long leaves of *Ampelodesma mauritanica,* frequently used by both species as digestive. We have also found bits of paper and plastic (bags) in the scats of the golden wolf, which confirms the exploitation of anthropogenic resources.

Specific composition of the diet

Frequency of occurrence

The analysis of the results reveals that the golden wolf consumes Fruits more frequently (present in 87.5 % of scats) than the other categories, followed by Large Mammals (LM) with a frequency of 50 %. The least regularly consumed categories are Small Mammals (SM), Birds and Waste, present in 25 % of collected scats. The common genet consumes more frequently Small Mammals (found in 75 % of the collected scats) followed by Birds and Fruits (62.5 % and 50 % respectively). Arthropods are found only in 37.5 % of feces. We note that genet's diet is less rich (4 food categories) than that of the golden wolf (6 food categories) (fig. 3).

The conversion of occurrence frequency into percentages allowed us to characterize the diet of both predators and to highlight the share of each category. The golden wolf consumes fruits and large mammals totaling more than 50 % of its diet, while the common genet consumes rather small mammals and birds (more than 50 % of the diet). The African golden wolf is, in theory, more opportunist than the genet by consuming resources of human origin, easier to acquire, with a proportion of 10 % (fig. 4).

Shannon Diversity Index (H′), Pielou's evenness index (J′) and Pianka's index (PCs)

The results showed that the African golden wolf diet is more diversified than that of common genets ($H'_{Wolf} = 1.667$, $H'_{Genet} = 1.355$). This result is confirmed by the diversity permutation test that shows a highly significant difference ($p = 0.0001$).

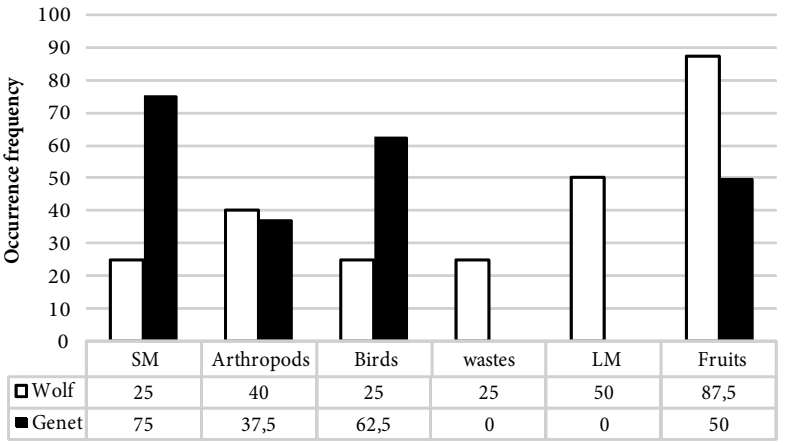

Fig. 3. Occurrence frequency of different food categories for both species.

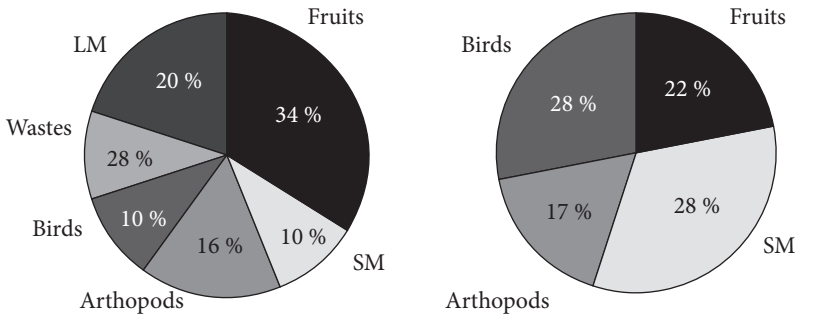

Fig. 4. Diets of the African golden wolf (left) and the common genet (right) in the study area.

Pielou's evenness index measured the distribution of occurrence frequencies of food categories for both species, regardless of species richness. Our results showed that the common genet's index is nearer to the maximum value of 1, which means that the distribution of food categories is more homogeneous in the genet than that of African golden wolf ($J'_{Wolf} = 0.930$, $J'_{Genet} = 0.977$).

The comparison between the niches for both species revealed that the trophic niche overlap was high resource partitioning between the two predators (Pianka's overlap index = 0.688).

Discussion

Our results reveal diversified diets ($H'_{Wolf} = 2.41$/ $J'_{Wolf} = 0.93$and $H'_{Genet} = 1.96$ / $J'_{Genet} = 0.98$). Such diversity can be explained by the heterogeneity of the Mediterranean habitats, making available a wide spectrum of preys (Di Castri, 1973, Raven, 1973).With a diet of 6 categories (large mammals, micro mammals, birds, arthropods, fruits and garbage), the African golden wolf is more generalist, confirming the results of several authors throughout its range, which describe a large trophic range consisting of reptiles, birds, rodents, mammals of different sizes, large numbers of insects and their larvae, it can even occasionally kill young gazelles or large prey mainly the wild boar and sheep (Lodé et al., 1991; Amroun et al, 2006; Eddine et al., 2017; Karssene et al., 2019). In Senegal, the golden wolf has been observed attacking herds of lambs (Gaubert et al., 2012). In our case, the only large mammal consumed by the African golden wolf is the wild boar, whose density is high in the region (Boumendjel et al., 2016). The African golden wolf probably feeds on corpses of hunted wild boars, since our study period coincides with the hunting period of the wild

boars in the region (Zemiti, 2012). Eddine et al. (2017) showed thatwild boarswere the most important prey in the Tlemcen hunting reserve, and that adult wild boars were likely consumed mostly as carrion, because of their tusks and aggressive behavior (Jedrzejewska and Jedrzejewski, 1998; Moehlman and Jhala, 2013).

Like the golden jackal (*Canis aureus*), the African golden wolf abundantly feeds fruits, which is the most frequently consumed category (87.5 %) in our study (Kingdon, 1988; Radovic and Kovacic, 2010). The common genet is generally classified by several researchers between the specialist species, like European otter (*Lutra lutra* (Linnaeus 1758)) and the generalist species like European badger (*Meles meles* (Linnaeus 1758)) (Delibes et al., 1989; Lodé et al., 1991; Ruiz-Olmo and Lopez-Martin, 1993; Carvhallo and Gomes, 2003; Sanchez et al., 2008; Le Jaques and Lodé, 2009; Camp, 2012; Amroun et al., 2014; Torre et al., 2013, 2015). Our results also confirm this intermediate position of genet, which consumes only 4 categories (micromammals, birds, arthropods and fruits).

The African golden wolf and the common genet are generalist species, and this characteristic gives them the opportunity to adopt different feeding strategies and thus avoid competitive pressure, especially for genets, which are the most vulnerable to different forms of interspecific competition (Caro and Stoner, 2003). In this way, niche overlap refers to the partial or complete sharing of resources or other ecological factors (predators, foraging space, soil type, and so on) by two or more species (Cornell, 2011). In our case, the trophic niche overlap was partial between the two predators (Pianka's overlap index = 0.688). Our result is lower than that calculated by Amroun et al. (2006) (Pianka's overlap index = 0.93 in Yakouren) at the wet season. It means that the overlap exists at a rate that minimizes competitive pressure. At the winter period, diets mainly constituted (more than 50 %) of fruits and large mammals for the African golden wolf and micromammals and birds for the common genet. This compromise in the use of environmental resources was also observed between these same species in Kabylie (Algeria) by Amroun et al. (2006). This phenomenon was explained by the size of consumed mammals; the African golden wolf consumes rather large mammals, not accessible to the genet, while its diet consists of micromammals. The competition pressure may also be diminished by the fact that the African golden wolf has a high tolerance for human activity and takes full advantage of the products and resulting wastes (Eddine et al., 2017; Yirga et al., 2017). Indeed, a significant part of waste (10 %) is found in its diet. This great capacity to exploit all environmental resources including those of anthropogenic origin and "easy to acquire", is less obvious for genet, which seems to be more vulnerable to any change in the environment, in particular to the fragmentation or deterioration of forest environments (Gomes and Giraudoux, 1992; Gomes, 1993) in which it is subservient (Roeder, 1984; Palomares and Delibes, 1988).

Conclusion

The understanding of the structure and functioning of ecosystems highlights the need to favor the inter-specific relations study, facing of various ecological conditions. As such, the analysis of an animal community must address the mechanisms that allow or facilitate coexistence of the species involved, taking into account the available resources, the range of resources used by each species and the inter-specific similarity in the use of these resources. These mechanisms, called "strategies", reflect the behavioral variability that each species develops in order to ensure the reproductive success and survival of individuals. Our results highlight the rather generalist nature of the two predators which exploit a wide range of trophic resources, an advantage allowing them to avoid the overlapping of the trophic niches. This is possible, both because of the richness of Mediterranean environments but also, by the opportunism of the golden wolf, which uses "easy-to-acquire" anthropogenic resources to move it away from its main role as regulator of the Mediterranean prey populations, while having serious repercussions on its state of health.

References

Amroun, M., Bensidhoum, M., Delattre, P., Gaubert, P. 2014. Feeding habits of the common genet (*Genettagenetta*) in the area of Djurdjura, north of Algeria. *Mammalia*, 78 (1), 35–43.

Amroun, M., Giraudoux, P., Delattre, P. 2006. A comparative study of the diets of two sympatric carnivores — the golden jackal (*Canis aureus*) and the common genet (*Genettagenetta*) in Kabylia, Algeria. *Mammalia*, 70 (3–4), 247–254.

Aulagnier, S. 1992. *Zoogeographie des mammiferes du maroc : de l'analyse specifique a la typologie de peuplement a l'echelleregionale*. Thèse doctorat d'état, Université des sciences et techniques du Languedoc, Montpellier, 1–235.

Bahlk, S. H. 2015. *Can hybridization be detected between African wolf and sympatric canids?* Master of Science Thesis.Center for Ecological and Evolutionary Synthesis Department of Bioscience Faculty of Mathematics and Natural Science, University of Oslo, Norway, 1–9 .

Bang, P., Dahlström, P. 1991. *Guide des traces d'animaux.* Delachaux et Niestlé, Paris, 1–240.

Boudy, P. 1952. *Guide du forestier en Afrique du Nord*. La maison rustique, Paris, 1–505.

Boukheroufa, M., Sakraoui, F., Benyacoub, S., Giraudoux, P., Raoul, F. 2009. Ecologie alimentaire de la genette commune (*Genetta genetta*) dans un écosystème forestier du parc national d'el Kala (Nord-est algérien). *Mésogée*, 65, 83–90.

Boumendjel, F. Z., Hadji, G. E. M., Valqui, J., Bouslama, Z. 2016. The Hunting Trends of Wild Boar (*Sus scrofa*) Hunters in Northeastern Algeria. *Wildlife Biology in Practice*, 12 (02) 1–13.

Camps, D. 2012. *Genetta genetta. In*: Enciclopedia virtual de los vertebrados españoles. Salvador, A., Cassinello, J., eds.. Museo nacional de ciencias naturales, Madrid, 1–25.

Caro, T. M., Stoner, C. J. 2003. The potential for interspecific competition among African carnivores. *Biological Conservation,* 110, 67–75.

Carvalho, J. C., Gomes, P. 2003. Feeding resource partitioning among four sympatric carnivores in the penedageres national park (Portugal). *Journal of Zoology, London*, 263, 275–283.

Chaline, J., Baudin, H., Jammot, D. U., Saint-Girons, M. C. 1974. *Les proies des Rapaces : petits Mammifères et leur environnement. Doin,* Paris, 1–141.

Chazel, M., Chazel, L. 2008. *Traces et indices des animaux des régions du Sud.* Nature au Sud, *Edisud*, 1–175.

Cornell, H. V. 2011. *Niche Overlap*. *In:* Hastings, A., Gross., L. Encyclopedia of Theoretical Ecology. University of California Press, (3), 489–497.

Dalerum, F., Cameron, E. Z., Kunkel, K., Somers, M. J. 2009. Diversity and depletions in continental carnivore guilds: implications for prioritizing global carnivore conservation. *Biology Letters*, 5 (1), 35–38.

Davidson, A., Birks, J. D. S., Brookes, R. C., Braithwaite, T. C., Messenger, J. E. 2002. The origin of faeces: morphological versus molecular methods surveying rare carnivores from their scats. *Journal of Zoology, London,* 257 (2), 141–143.

Day, M. G. 1966. Identification of hair and feather remains in the gut and faeces of stoats and weasels. *Journal of Zoology*, 148, 201–217.

De Smet, K., Hamdine, W. 1988. Densités de Genettes (*Genetta genetta* Linne, 1758) en yeuseraie Algerienne. *Mammalia,* 52 (4), 604–607.

Debrot, S., Fivaz, G., Mermod, C., Weber, J. M. 1982. *Atlas des poils de Mammifères d'Europe*. Institut de Zoologie de l'Université de Neuchatel, Switzeland, 1–208.

Delibes, M., Rodriguez, A., Parreno, F. F. 1989. Food of the common genet (*Genetta genetta*) in Northen Africa. *Journal of Zoology, London*, 218, 321–326.

Di Castri, F. 1973. Animal biogeography and ecological niche. *In*: Di Casri, F., Mooney, H. A., eds. *Mediterrean type ecosystems, origins and structure*. Springer, Berlin, 279–283.

Eddine, A., Mostefai, N., De Smet, K., Klees, D., Ansorge, A., Karssene, Y., Nowak, C., Van Der Leer, P. 2017. Diet composition of a newly recognized canid species, the African golden wolf (*Canis anthus*), in northern Algeria. *Annales Zoologici Fennici,* 54, 347–356.

Gaubert, P., Bloch, C., Benyacoub, S. 2012. Reviving the African wolf *Canis lupus lupaster* in North and West Africa : a mitochondrial lineage ranging more than 6,000 km wide. *PlosONE*, 7 (8), E42740.

Gomes, P. T. 1993. Space use by a carnivore mammal, *Genetta genetta,*L.: importance of landscape structure. *International Union of Game Biologists, XXI Congress*, Halifax, 265–267.

Gomes, P. T., Giraudoux, P. 1992. Structure du paysage et habitat de la Genette (*Genetta genetta*, L.). *XV^{ème} Colloque Francophone de Mammalogie: Les carnivores*, 59-63.

Hamdine, W., Thevenot, M., Sellami, M., De Smet, K. 1993. Régime alimentaire de la genette (*Genetta genetta,* L.) dans le parc national du Djurdjura, Algérie. *Mammalia*, 57(1), 9–18.

Hammer, O., Harper D. A. T., Ryan. P. D. 2001. PAST: Paleontological Statistic software package for education and data analysis. *Paleontologia Eletronica,* 4 (1), 1–9.

Jedrzejewska, B., Jedrzejewski, W. 1998. *Predation in vertebrate communities: the Bialowieza Primeval Forest as a case study*. Springer Verlag, Berlin, 1–452.

Karssene, Y., Chammem, M., Li, F., Eddine, A., Hermann, A., Nouira, S. 2019. Spatial and temporal variability in the distribution, daily activity and diet of fennec fox (*Vulpes zerda*), red fox (*Vulpes vulpes*) and African golden wolf (*Canis anthus*) in southern Tunisia. *Mammalian Biology,* 95, 41–50.

Kingdon, J. 1988. East *African Mammals: An Atlas of Evolution in Africa, Part A: Carnivores*. University of Chicago Press, Chicago, (3), 1–491.

Klare, U., Kamler, J. F., Stenkewitz, U., Macdonald, D. W. 2010. Diet, prey selection, and predation impact of black-backed jackals in South Africa. *Journal of Wildlife Management,* 74, 1030–1042.

Koepfli, K., Pollinger, J., Godinho, R., Robinson, J., Lea, A., Hendricks, S., Schweizer, R. M., Thalmann, O., Silva, P., Fan, Z., Yurchenko, A. A., Dobrynin, P., Makunin, A., Cahill, J. A., Shapiro, B., Álvares, F., Brito, J. C., Geffen, E., Leonard, J. A., Helgen, K. M., Johnson, W. E., O'brien, S. J., Valkenburgh, B. V., Wayne, R. K. 2015. Genome-wide Evidence Reveals that African and Eurasian Golden Jackals Are Distinct Species. *Current Biology,* **25**, 58–65.

Le Jacques, D., Lod**é**, T. 2009. L'alimentation de la Genette d'Europe, *Genetta genetta* L., 1758, dans un bocage de l'ouest de la France. *Mammalia,* 58 (3), 383–390.

Livet, F., Roeder, J. J. 1987. La Genette (*Genetta genetta*, L., 1758). *Encyclopédie des Carnivores de France*, 16, 1–31.

Lod**é**, T., Lechat, I., Le Jacques, D. 1991. Le régime alimentaire de la Genette en limite nord- ouest de son aire de repartition. *Revue écologie (terre vie),* 46, 339–348.

Lozé, I. 1984. Régime alimentaire et utilisation de l'espace chez la genette **(***Genetta genetta). Mémoire de D. E. A. de biologie du comportement, Université de Paris,* 7, 1–22.

Macdonald, D. W. 1980. Patterns of scent marking with urine and faeces amongst carnivore communities. *Symposia of the Zoological Society of London,* 45, 107–139.

Moehlman, P. D., Jhala. Y. V. 2013. Golden jackal (*Canis aureus*). *In*: Kingdon, J. and Hoffman, M. *Mammals of Africa,* Bloomsbury, London, 5, 35–38.

Naves, J. Wiegand, T., Revilla, E., Delibes, M. 2003. Endangered species constrained by natural and human factors: the case of brown bears in Northern Spain. *Conservation Biology,* 17 (5), 1276–1289.

Oubellil, D. 2010. Sélection de l'habitat et écologie alimentaire du chacal doré *Canis aureus algirensis* dans le parc national de djurdjura. *Thèse de magister, Université de Tizi-ouzou,* 86–123.

Palomares, F., Delibes, M. 1988.Time and space use by two common genets (*Genetta genetta*) in the donana national park, spain. *Journal of mammalogy,* 69 (3), 635–637.

Pianka, E. R. 1973. The structure of lizard communities. Annual Review of *Ecology and Systematics*, 4, 53–74.

Radovic, A., Kovacic, D. 2010. Diet composition of the Golden jackal (*Canis aureus* L.) on the Pelješac Peninsula, Dalmatia, Croatia. *Periodicumbiologorum*, 112, 219–224.

Raven, P. 1973. The evolution of Mediterranean floras. *In*: Di Casri, F., Mooney, H. A., eds. *Mediterranean type ecosystems*. Chapman & Hall, London, 213–224.

Reinthal, P. N. 1990. The feeding habits of a group of herbivorous rock-dwelling cichlid fishes (Cichlidae: Perciformes) from Lake Malawi, Africa. *Environmental Biology of Fishes*, 27, 215–233.

Roeder, J. J. 1980. Les emplacements de défécation chez la Genette. *Revue écologie (Terre Vie)*, 34, 485–494.

Roeder, J. J. 1984. Ontogenese des systèmes de communication chez la Genette (*Genetta genetta* L.). *Behaviour,* 90, 259–301

Ruiz-Olmo, J., Lopez-Martin, M. 1993. Note on the diet of the commun genet (*Genetta genetta*, l.) in mediterranean riparian habitats of n. e. Spain. *Mammalian biology*, 57 (4), 607–610.

Saint-Girons, M. C., Petter, F. 1965. *Les Rongeurs du Maroc*. Travaux de l'inst. Scient. Cherifien. Serie. Zool, Rabat, (31), 1–55.

Sanchez, M., Rodrigues, P., Ortuño, V., Herrero, J. 2008. Feeding habits of the *Genetta genetta* in an iberian continental wetland. *Hystrix,* 19 (2), 133–142.

Torre, I. Arrizabalaga, A. Freixas, L. Ribas, C. Flaquer, M. Diaz, P. 2013. Using scats of a generalist carnivore as a tool to monitor small mammal communities in mediterranean habitats. *Basic and applied ecology,* 14, 155–164.

Torre, I, Arrizabalaga, H., Ribas, A. 2015. The diet of the genet (*Genetta genetta* Linnaeus, 1758) as a source of information on local qmall mammal communities. *Galemys*, (4) 27, 1–5.

Wilson, D., Reeder, D. M. 1993. *Mammals species of the world, a taxonomic and the geographic reference*. Second edition, Smithsonian Institution Press, Washington and London, 1–207.

Yirga, G., Leirs, H., De longh, H. H., Asmelash, T., Gebrehiwot, K., Vos, M., Bauer, H. 2017. Densities of spotted hyaena (*Crocuta crocuta*) and African golden wolf (*Canis anthus*) increase with increasing anthropogenic influence. *Mammalian Biology,* 85, 60–69.

Zemiti, B. 2012. *Connaissez-vous la période de chasse et le statut phénologique de notre gibier ? [Do you know the hunting period and phenological status of our game animals?] Bulletin d'information et de vulgarisation*. La lettre cynégétique, Centre Cynégétique de Zéralda, Alger, 1–30.

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