

feeding areas include both arable land and pastures interspersed with scattered trees or shrubs that can provide natural hunting perches (Ajder & Baltag 2017). Their diet is predominantly composed of insects supplemented by vertebrates (Karlsson 2004, Morelli et al. 2013, Taibi et al. 2009). Caching is performed by shrikes to demarcate territories, store food for inclement weather or periods of stress in the breeding cycle, divide labor between the breeding pair and for "aging" while deterrent chemicals in prey decompose (Yosef & Pinshow 2005). The diet in use pellets of Southern Grey Shrike has been well studied in Europe, especially in Spain from the *meridionalis* sub-species (Hernández et al. 1993) and in France (Hóðar 2006, Lepley et al. 2004), there are studies on *aucheri* sub-species (Yosef et al. 1991, Budden & Wright 2001) and the *koenigi* sub-species (Padilla et al. 2005) in Canary Islands. The pellets diet of *algeriensis* and *elegans* sub-species in Maghreb (north of Africa) have been studied by Taibi et al. (2009), Taibi et al. (2011), Taibi & Doumandji (2015) and Taibi et al. (2015). No reports on the shrike's diet about larder have yet been published in Arabic peninsula and Maghreb. In this paper, we present the first documented observations of this larders diet for the Southern Grey Shrike in Algeria. The aim of this study was to compare diet composition by Larders in two different areas in Algeria during the period of 2006 to 2011.

Study area. The first area is Ramdhanian (50 hectare) was located in the North of Algiers, Algeria (36° 38' N.; 3° 09' E.). The dominant environment is constituted by farmland composed mainly of arable fields, meadows, pastures and parcel of wheat and veg delimited by hurdle olive trees of different ages. The study was carried out during the spring of 2006, 2007, 2008 and 2009. The second area is Bouhannak (50 hectare) was located in Northwestern Algeria, in Tlemcen (34° 54' N.; 1° 20' W.). This area was covered by no arable fields, meadows and pastures. The land was continued rock and stone that attract the Shrikes. The dominant environment in the study area is constituted by olive trees. The study was conducted during 2010 and 2011 spring.

Diet analyses. Breeding territories of the Southern Grey Shrike were regularly observed. During these visits the vicinity of territorial, to a radius of 100 meters, were surveyed for impaled prey items. The larders were collected and conserved in plastic bottle with ethanol at 70°. They were fetched in the laboratory for examination and determination of species using binocular. Prey availability was estimated by pitfall traps for arthropods.

Ecological index and statistical analysis. First, the relative frequency (RF %) is uses; the standard of Sturge has been utilized (Scherrer 1984). The second is the relative biomass (B %), there is calculating in the mass of the individuals of a prey species as a percentage of the total mass of prey. To evaluate diet selection of the main groups of animal's consumption, the Ivlev's index (Johnson 1980) was applied. Ivlev's index ranges from +1 to -1, with values close to +1 indicating consumption at much greater proportions than availability, those near -1 indicating prey taken considerably below availability (Souffou et al. 2007). Chi² test has been used in order to compare the diet in the two areas; and to test the differences in Vertebrates and Invertebrates items. Results were reported as significant at a value of $p < 0.05$.

Food larders of the Southern Grey Shrike *Lanius meridionalis algeriensis* (Laniidae, Passeriformes) in Algeria

Laniidae family was characterized by stock food on the impaled prey in the plants thorn and barbed. This family employs the unique behaviour of impaling prey and like many other avian species of creating larders (Tryjanowski et al. 2003, Yosef & Pinshow 2005, Dylewski et al. 2017). The Southern Grey Shrike is a predatory passerine species and inhabits mixed agricultural/natural landscapes (Moreno-Rueda et al. 2016). The Shrikes store the nutrition in plants thorn, barbed and branch of trees for the roll of stock (Brown et al. 2005, Morelli et al. 2015, Dylewski et al. 2017). Their

A total of 136 preys larders of the Southern Grey Shrike were collected in the north of Algeria, including 17 larders in Ramdhanian area (Algiers) and 119 larders in Bouhannak area (Tlemcen). Despite systematic searching, only six caches were found in Ramdhanian area, (Table 1). However; in Bouhannak area, the number of individuals was bigger (Table 2),

Table 1. Relative frequency and occurrence frequency in the larders of the Southern Grey Shrike at Ramdhanha (Algiers). Phyl./clas./ordr., Phylum class or order; NP, number of prey items; RF%, Relative frequency; OF%, occurrence frequency; B%, percentage of wet biomass; liv, values of Ivlev index; sp. und., species undetermined.

Phyl./clas./ordr.	Species	NP	RF%	OF%	B%	liv
Invertebrata						
Myriapoda	Chilopoda sp. und.	6	35.29	66.67	0.54	+1
Insecta	<i>Macrothorax morbillosus</i>	1	5.88	16.67	1.61	-0.79
	<i>Geotrupes</i> sp.	1	5.88	16.67	1.18	-0.79
	<i>Silpha granulata</i>	1	5.88	16.67	0.43	+1
	<i>Bombus</i> sp.	2	11.76	33.33	0.64	+1
Invertebrata subtotal		11	64.69		4.40	
Vertebrata						
Amphibia	<i>Discoglossus pictus</i>	2	11.76	33.33	21.48	-
Squamata	<i>Chalcides ocellatus</i>	1	5.88	16.67	32.22	-
Aves	<i>Erithacus rubecula</i>	1	5.88	16.67	21.48	-
Rodentia	<i>Mus spretus</i>	2	11.76	33.33	20.41	-
Vertebrata subtotal		6	35.28		95.60	

Table 2. Relative frequency and occurrence frequency in the larders of the Southern Grey Shrike at Bouhannak area (Tlemcen). Phyl./clas./ordr., Phylum class or order; NP, number of prey items; RF%, Relative frequency; liv, values of Ivlev index; B%, percentage of wet biomass; OF%, occurrence frequency; sp. und., species undetermined.

Phyl./clas./ordr.	Species	NP	RF%	OF%	B%	liv
Invertebrata						
Scorpionida	<i>Buthus occitanus</i>	2	1.68	22.22	5.53	+1
Annelida	Annelida sp. und.	1	0.84	11.11	8.84	+1
Myriapoda	Chilopoda sp. und.	1	0.84	11.11	0.55	+1
	<i>Iulus</i> sp.	3	2.52	11.11	0.22	+1
Insecta	Orthoptera sp. und.	3	2.52	11.11	0.44	-0.9
	<i>Geotrupes</i> sp.	53	44.54	55.56	1.22	+1
	<i>Pimelia grandis</i>	17	14.29	55.56	1.55	+1
	<i>Asida</i> sp.	24	20.17	77.78	0.11	+1
	<i>Trox</i> sp.	3	2.52	22.22	0.11	+1
	<i>Brachycerus</i> sp.	3	2.52	22.22	0.08	-0.9
	<i>Timarcha</i> sp.	1	0.84	11.11	0.01	+1
	<i>Copris lunaris</i>	1	0.84	11.11	1.11	+1
Invertebrata subtotal		112	94.12		19.76	
Vertebrata						
Rodentia	<i>Mus spretus</i>	1	0.84	11.11	21.00	-
Squamata	<i>Chalcides ocellatus</i>	1	0.84	11.11	33.16	-
	Ophidia sp. und.	4	3.36	22.22	22.10	-
	Lacertidae sp. und.	1	0.84	11.11	3.98	-
Vertebrata subtotal		7	5.88		80.24	

it was composed of 16 caches, containing 119 impaled preys. The mean population density of *Lanius meridionalis algeriensis*, in 50 ha zone, was about 10 pairs in Ramdhanha and 8 pairs in Bouhannak.

In Ramdhanha the rate of rare species was the highest with 55.6 %, accidental species is in the second-rate with 33.3 %. The relative frequency of Invertebrate subtotal is important (64.69 %) compared with Vertebrate subtotal (35.28 %), but in the percentage of wet biomass the Invertebrate is smaller (4.4 %) compared with Vertebrate (95.6 %) (Table 1).

The values of Ivlev's index had Chilopoda sp. und., *Silpha granulata* and *Bombus* sp. as the most preferred species (+1), but *Macrothorax morbillosus* (-0.79) and *Geotrupes* sp. (-0.79) were the least selected prey.

At Bouhannak area, the category of very rare species dominated with 56.3 %, followed by the category of rare species with 25 % and regular species with 12.5 %. The constants were represented by only one species (6.3 %).

In Tlemcen, the relative frequency of Invertebrate subto-

tal is high (94.12 %) compared to Vertebrate subtotal, but in the percentage of wet biomass of vertebrate is very high (80.24 %) compared with invertebrate.

The values of Ivlev's index as the most preferred species in the diet larder with +1, just two species were the least selected prey with -0.9 (*Orthoptera* sp. und. and *Brachycerus* sp.).

The relative frequency of vertebrate and invertebrate preys varied significantly between two areas ($X^2 = 14.9$, $N = 3$, $p = 0.001$).

Our study demonstrated that among the Southern Grey Shrike observations in Algeria, the limited sample size in Ramdhanha compared to Bouhannak was probably caused by the human disturbance and the agricultural action in the first area. The role of the larder is to stock diet in winter and to make boundary of territorial capture. This behaviour could also play an important informative role, signaling the quality of the territory or territory owner (Morelli et al. 2012). They usually impale and wedge prey for dismembering large prey and dividing them into parts in a following

time (Morelli et al. 2013). Just before the capture of prey the Shrike get rid of the indigestible part as Elytra (Lefranc 1993). In addition, the prey is a small animal, the Shrike fixed in the thorn and barbed for impale or build the victim. Prepare larders is the essential character of the Laniidae (Issa & Lefranc 2011). Shrikes should selectively forage from some specific places to increase prey detection rates in order to optimise the energetic cost of hunting (Morelli et al. 2016). The results obtained in this study agree with other research report in *Lanius meridionalis* diet, which suggest that the main food source in term of number of individuals is based on Insects, especially Coleopteran. However, the number of beetles observed in Ramdhanian is small compared with *Chilopoda* sp. und. because the number of samples is very limited, and it was an agricultural area with any insecticidal dispersal in the fields. In contrast, in terms of biomass the snakes and lizards dominated the diet. The Shrike choose the prey with big biomass to preserve the energy. The composition of cached prey was dominated by insects (mainly bumble bees, beetles and grasshoppers) in numbers of prey and by birds, snakes and lizards biomass (Morelli et al. 2012, Morelli et al. 2013). In the warmest and sunniest seasons, ectotherms such as lizards show their greatest activity. Moreover, lizards are available all year round and are thus attractive prey for Southern Grey Shrikes (Padilla et al. 2005). Our results showed that the Southern Grey Shrike select his prey, however several beetles (*Macrothorax morbillosus* and *Geotrupes* sp. in Ramdhanian; *Brachycerus* sp. in Bouhannak) are note selected. This result coincide with those recorded in the Canary Islands by that the Southern Grey Shrikes diet in pellets showed positive prey selection in groups such as Coleoptera, Hymenoptera and Orthoptera (Padilla et al. 2005).

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