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MORPHOMETRICS AND DIETARY COMPOSITION OF THE ALGERIAN WALL GECKO *TARENTOLA NEGLECTA* (SQUAMATA: PHYLLODACTYLIDAE) IN SOUTH-EASTERN ALGERIA

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Abstract. The diet composition, prey diversity, and body size of *Tarentola neglecta* Strauch, 1895 were investigated in the palm groves of south-eastern Algeria. This study aimed to identify the different prey items and species consumed by *T. neglecta* and to explore whether there is a relationship between prey number, length and volume and the gecko's snout-vent length. *T. neglecta* was captured, measured, and analyzed for stomach contents. Lizards were collected from 2016 to 2017, and stomach-flushes to identify prey were categorized and measured. Prey items were identified under a microscope and categorized taxonomically. Diet diversity was measured with different indices, and statistics were used to examine relationships between body size and feeding traits. A total of 121 adult individuals were captured, with 100 (47 males, 39 females, and 14 juveniles) containing stomach contents. This study identified 315 prey items across three classes, 14 orders, and 37 families. *T. neglecta* exhibits a diverse diet (FNB = 16.6, H' = 4.9) consisting of arthropods. Insects dominated the diet (90.2%), with arachnids making up only 2.8% of consumed prey. The housefly was the most important prey item, representing 16.2% of total abundance, with an occurrence frequency of 29% and a relative importance of 36.9%. Diet overlap was high between adult females and juveniles (95%) and between males and females (71%). Prey volume and length increased significantly with snout-vent length, while prey number showed no notable change. Overall, *T. neglecta* demonstrates opportunistic and adaptable insectivorous behaviour in the date palm groves of Oued-Souf.

INTRODUCTION

Biodiversity monitoring across different forms and levels is a central focus of global scientific policy aimed at preventing species extinction and mitigating ecosystem perturbations (Hooper et al. 2012). Environmental degradation driven by various factors contributes significantly to biodiversity loss, species extinction, and the decline of ecosystem quality (Scanes and Toukhsati 2018).

North Africa is characterized by complex and diverse ecosystems, holding significant biogeographical interest, particularly reptiles (Chenchouni 2012; Mouane et al. 2013). However, compared to other North African countries, the Algerian herpetofauna remains underexplored. Many species, such as *Acanthodactylus aureus*, *Cyrtopodion scabrum*, *Scincopus fasciatus*, *Scincus scincus*, *Tarentola hoggarensis*, and *Uromastyx acanthinura*, face unresolved issues regarding their taxonomy and ecological distribution. Studies on these species remain insufficient (Beddek 2017; Mouane et al. 2013, 2021; Liz et al. 2022; Rouag et al. 2024).

In Algeria, lizards feed exclusively on invertebrates (Arab and Doumandji 2003; Rouag et al. 2007; Rouag 2015). However, detailed studies on their diet are lacking (Mouane 2020). Among the recorded Phyllodactylidae in Algeria, seven species across two genera such as *Ptyodactylus* and *Tarentola* are known (Mouane et al. 2013, 2021; Beddek 2017). The Algerian wall gecko (*Tarentola neglecta* Strauch 1895) is represented with three subspecies and is primarily found in bushy vegetation and oases from sandy deserts in Algeria, Tunisia, and extreme western Libya (Gauthier 1967; Joger 2003; Joger et al. 2006; Trape et al. 2012).

T. neglecta is predominantly insectivorous. However, information on its diet remains limited, with most studies based on anecdotal observations or small sample sizes (Schleich et al. 1996; Trape et al. 2012; Mouane et al. 2020). Prey diversity includes insects from various orders, particularly Coleoptera and Diptera, which are prevalent in the Sahara ecosystem (Bellakhal et al. 2010). Given the vulnerability of Saharan lizards and these data gaps, there is a clear need for more comprehensive studies on their ecology, feeding behaviour, and biomorphometrics.

This study aimed at examining the morphology and diet of *T. neglecta* in the Northern Sahara of Algeria (Oued-Souf) focusing on comparative analysis of morphological traits between sexes and age groups. The research aims to provide new insights into the diet composition, prey diversity, trophic niche breadth, and feeding niche overlap and to explore the relationships between gecko size and prey characteristics, including prey number, size, and volume.

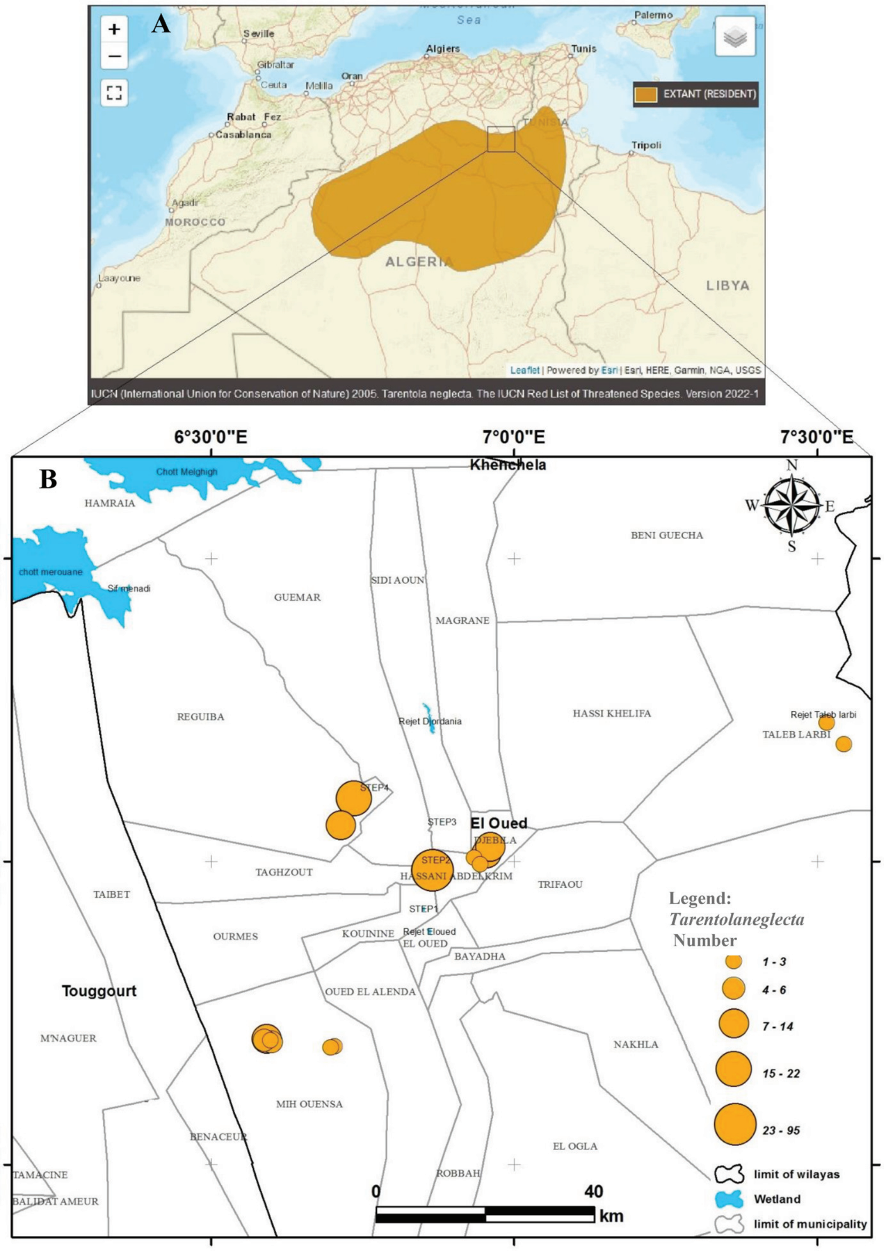

Figure 1. A: Map of known distribution of the Algerian wall gecko (*Tarentola neglecta*) (following Joger et al. 2006). B: Location of sampling sites in date palm groves, showing the number of individuals recorded in each site in the northern Algerian Sahara Desert.

MATERIALS AND METHODS

Study area

The study was conducted in the Oued-Souf region in the northern Sahara Desert of Algeria between September 2016 and June 2017. This area is characterized by a distinctive agrosystem dominated by date palm groves, locally known as "Ghout," situated within the expansive sand dunes of the "Oriental Erg." Geographically, Oued-Souf is situated in south-eastern Algeria (6°30'E, 33°33'N, average altitude = 80 m a.s.l.) (Figure 1). The climate is extremely hot and hyperarid with an extended dry season lasting from February to December. The average air temperature ranged from 11.5°C in January to 34.3°C in July. Annual rainfall averaged 63.2 mm, with the rainy season occurring in January (Voisin 2004; National Weather Service 2017).

Sampling, body measurements and diet examination

The study focused on the Algerian wall gecko (*Tarentola neglecta*), a species found primarily in abandoned or still managed palm groves. This species exhibits a preference for environments with date palms and organic matter from cut plants, with most individuals captured under dead palm fronds (locally known as Kournaf of *Phoenix dactylifera*). Although this species is adapted to desert conditions, it is not found in natural Saharan habitats but rather prefers the more favourable conditions of palm oases.

Lizards were captured by hand on a weekly basis from 16:30 to 21:30 with a focus on areas beneath piles of organic matter of cut plants and palm-tree fronds. The captured *Tarentola* individuals were grouped by sex and size, with juveniles defined as having a snout-vent length (SVL) of less than 25 mm (Schleich et al. 1996). Males were distinguished from females by hemipenal bulges, enlarged preanal and femoral pores, and slightly larger SVL, while females lack these features. These traits allowed reliable sex differentiation in the field (Zuffi et al. 2011; Vasconcelos et al. 2017).

Using a digital caliper, morphological traits on each individual were measured: total body length (BL), snout-vent length (SVL), vent tail length (TL), foreleg length (FLL) and hindlimb length (HLL) (Figure 2). Each individual was weighed to determine body weight (Wt) using digital balance with 0.01 g of precision.

Diet analysis was performed through stomach content examination. Each lizard underwent stomach-flushing, a process that involves using syringes with rubber-coated tips to gently flush the stomach contents. Plastic segmented rings were employed to keep the mouth open during the procedure (Legler and Sullivan 1979). This methodology has facilitated the detection of prey, including larvae and other soft-bodied prey (e.g., spiders and larvae) that were more prevalent in gut contents

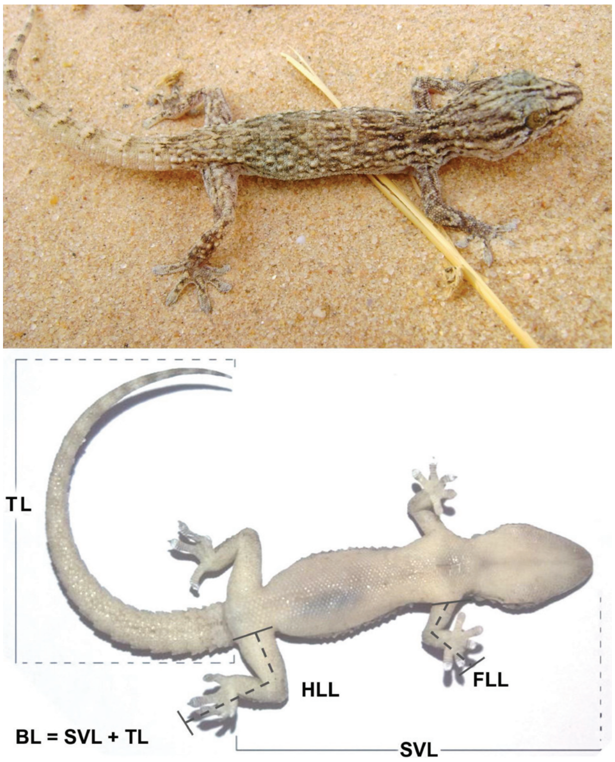

Figure 2. Upper photo: photograph of an Algerian wall gecko captured in Oued-Souf. Lower photo: body measurements of *Tarentola neglecta* (FLL: foreleg length, HLL: hind limb length, BL: total body length, SVL: snout-vent length, TL: tail length) (photographs by Aicha Mouane).

compared to faecal pellets. These organisms were disregarded in prior research due to their elevated digestibility (Pérez-Mellado et al. 2011). The analysis provided detailed information on the composition, diversity, and size of the prey consumed by *T. neglecta*.

After processing, all *T. neglecta* specimens were released at their original capture sites within 24 hours. Of the 121 geckos captured (56 adult males, 44 adult females, and 21 juveniles), 21 individuals had empty stomachs and were excluded from the analysis, resulting in a final sample of 100 stomach-flushed individuals (47 adult males, 39 adult females, and 14 juveniles). Prey items of each stomach-flush were identified under a stereo microscope (magnification: 10 × 2–4) and classified into taxonomic categories down to the species level when possible. The arthropod prey species were determined based on identification keys and taxonomic guides (Perrier 1926, 1932, 1979; Chopard 1943; Balachowsky 1962; Zahradnik 1984).

Diet data analysis

Morphometric data and diet characteristics were analyzed separately for each gecko sex as well as for both sexes. Prey frequency (PF) was defined as the percentage proportion of a specific prey species in the total diet. Species richness (SR) was quantified using the total number of identified prey species (Magurran 2004).

The mean prey species richness (Sm) was calculated by averaging the prey species richness observed across a batch of stomach contents (per gecko sex or total) (Chenchouni 2014). The trophic diversity of prey found in the stomach contents of males, females and juveniles was calculated using the Food Niche Breadth "FNB": FNB = $1/\Sigma P_i^2$, where P_i = the proportion (or relative abundance) of prey species i in the diet ($P_i = n_i/N$) (Levins 1968). Shannon diversity index ($H' = -\Sigma (P_i \times \log_2 P_i)$) and evenness ($E = H'/H_{max}$, with $H_{max} = \log_2 SR$) were calculated to assess diet diversity (Magurran 2004).

The frequency of occurrence (Occ) was calculated by dividing the number of stomach-flushes in which the species was found by the total number of samples examined. The identified prey species were classified into four groups: highly rare prey (HR) (Occ < 12.5%); rare prey (RE) (Occ = 12.5–24%); common prey (CM) (25–49%), and constant prey (CN) (Occ ≥ 50%) (Magurran 2004; Chenchouni 2014).

In order to assess the degree of food specialization for each sex/age group, we employed the Berger-Parker dominance index (*d*), which is calculated as $d = ni\ max/N$, where *N* represents the total number of recorded food components (taxa), and ni max refers to the number of specimens from the most abundant taxon i in the diet. The Berger-Parker index ranges from 1/*N* to 1. A higher degree of prey selection specialization is indicated by values closer to 1, while values closer to 1/*N* are typical of species that are general feeders (polyphage) (Magurran 2004).

Pianka's index of niche overlap (O_{jk}) was used to determine the dietary similarity between adult males, adult females, and juveniles (Pianka 1973): $O_{jk} = \Sigma (P_{ij} \times P_{ik}) / \sqrt{((\Sigma P_{ij}^2)(\Sigma P_{ik}^2))}$, where P_{ij} and P_{ik} is the proportion of use of food item *i* for the sex/age categories *j* and *k*, respectively.

The volume of each prey item (mm^3) was estimated using the spheroid volume formula. The formula for calculating volume = $4/3\ \pi \times (L/2) \times (W/2)^2$, where L= prey length and W = prey width (Colli et al. 2003; Bonfiglio et al. 2006).

In addition, the importance of each food item consumed (*i*) was described by the index of relative importance (IRI), which was calculated as $IRI_i = \%Occ_i\ (\%PF_i + \%V_i)$, where % Occ is prey occurrence frequency (in%), % PF is prey frequency (in%), and $\%V_i$ is the percent of the volume of prey item *i* in all stomach-flushes (Pinkas et al. 1970).

Statistical analysis

Statistic analyses and graphics were carried out using the statistical software R (R Core Team 2021) version R 4.1.0. Morphological data were summarized as mean, standard deviation and range (max–min) for both sexes. The variation of each biometric trait between sexes was tested using a linear model. The relationship between body length (BL) and weight (Wt) was analyzed using a power regression equation: $Wt = a.BL^b$, linearized as: log (Wt) = log (a) + b.log (BL).

In addition, linear regressions were applied to test the interrelations between BL, SVL, FLL and HLL for different sexes of adults and for juveniles. The unpaired t test was carried out to explore differences between males and females in terms of morphological traits. The relation between SVL prey length and prey volume was evaluated using linear regression at $p = 0.05$. On the other hand, Poisson regression model was used to evaluate the relation between SVL and prey abundance. The variation in the distribution of prey counts per different prey sizes was tested using Pearson's Chi-squared test.

RESULTS

Morphometric traits

In date palm groves of Oued-Souf, the Algerian wall gecko (AWG, n = 100) had a maximum body length of 106 mm with an average of 72.3 ± 15.9 mm (average ± standard deviation), including 34.9 ± 8.4 mm for SVL and 37.3 ± 9.9 mm for TL. The HLL averaged 23.9 ± 2.4 mm (Table 1) slightly longer than the forelimbs length (FLL = 19.6 ± 2.3 mm) measured in 86 adult individuals. Linear regressions revealed significant relationships ($p < 0.05$) between body morphological measurements: BL–SVL ($R^2 = 0.72$, $F = 254.2$, $p < 0.0001$) (Figure 3A), BL–TL ($R^2 = 0.79$, $F = 385.8$, $p < 0.0001$) (Figure 3B), SVL–FLL ($R^2 = 0.72$, $F = 228.8$, $p < 0.0001$) (Figure 3C), and SVL–HLL ($R^2 = 0.73$, $F = 247.9$, $p < 0.0001$) (Figure 3D). These relationships were also significant ($p < 0.001$) for adult females, adult males and juveniles (Figure 3; Table 1).

Table 1. Descriptive statistics of morphological traits for males, females, and juveniles of *Tarentola neglecta.*

Variables	Females	Males	Juveniles	Total
Total length (mm)	74.8 ± 10.9	77.8 ± 14.5	47.2 ± 6.6	72.3 ± 15.9
Snout-vent length (mm)	36.1 ± 5.5	37.3 ± 8.7	23.9 ± 5.6	34.9 ± 8.4
Tail length (mm)	38.7 ± 7.7	40.5 ± 9.1	23.3 ± 4.6	37.3 ± 9.9
Foreleg length (mm)	13.2 ± 2.2	15.7 ± 1.6	/	14.4 ± 2.3
Hindlimb length (mm)	17.5 ± 2.06	20.6 ± 1.7	/	19.1 ± 2.4

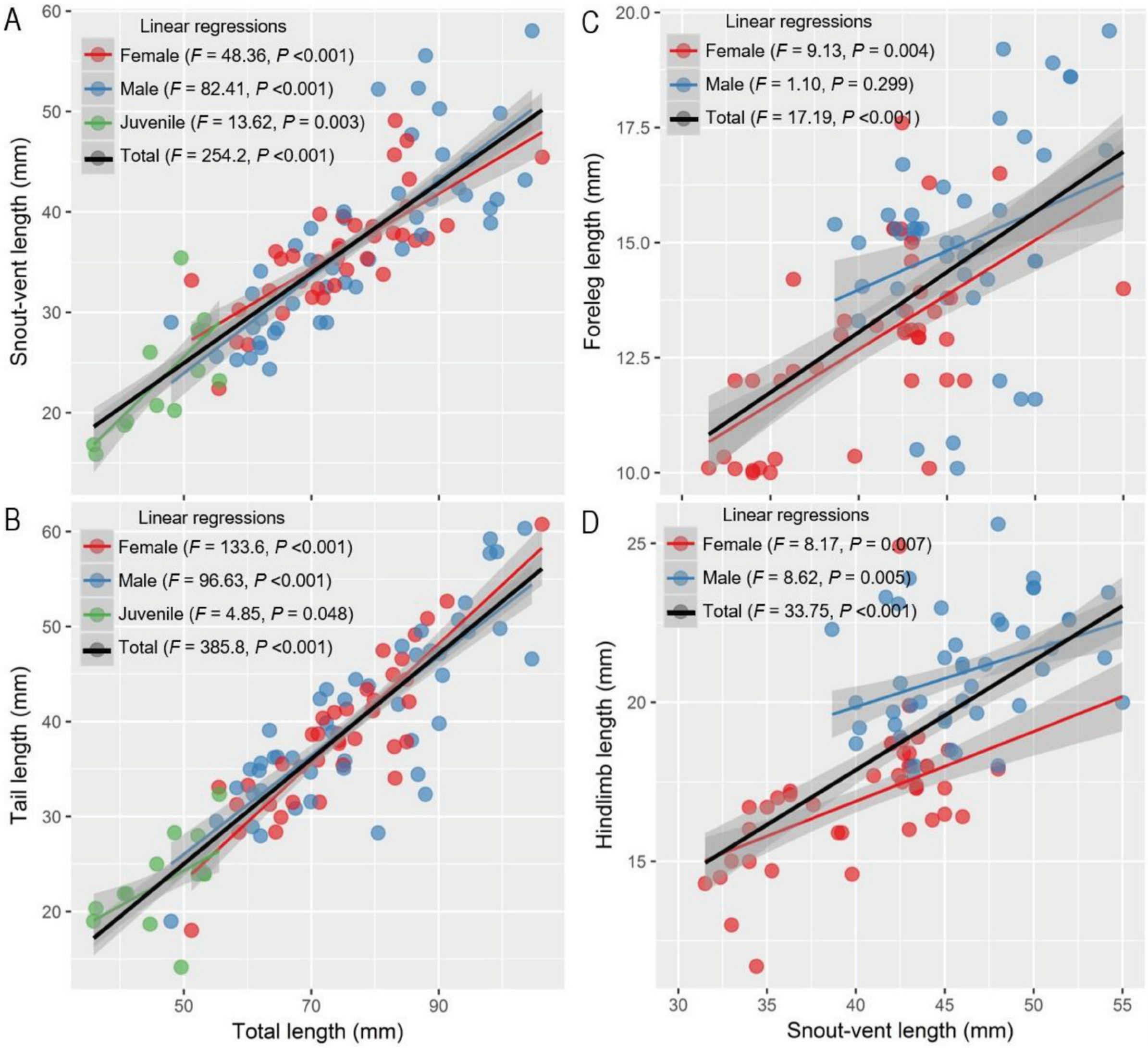

Figure 3. Linear relationships between total body length and snout-vent length (A), total body length and tail length (B), snout-vent length and foreleg length (C), and snout-vent length and hindlimb length (D) of *Tarentola neglecta* from Oued-Souf, Algerian Sahara Desert. Point colours are mapped to adult males, adult females and juveniles. The solid lines represent linear regressions obtained by a linear model fit with confidence regions in light grey.

Variation of body morphometrics between sexes

The average FLL and HLL of adult males (FLL = 15.7 ± 1.6 mm; HLL = 20.6 ± 1.7 mm) was significantly higher ($p < 0.001$) than that of adult females (FLL = 13.2 ± 2.2 mm; HLL = 17.5 ± 2.06 mm) (Table 1) ($p < 0.001$), but both sexes did not differ in body weight (t = 0.46, $p = 0.650$), BL (t = 1.06, $p = 0.291$), SVL (t = 0.74, $p = 0.462$), and TL (t = 0.98, $p = 0.328$) (Figure 4).

Length-weight relationship

Based on the measurements of BL and Wt for 86 individuals (39 females and 47 males), the length-weight relationship in AWG had a similar pattern for females ($Wt = 0.894e^{0.0144BL}$) and for both sexes ($Wt = 1.0497e^{0.0124BL}$), whereas the males ($Wt = 1.4488e^{0.0081BL}$) showed a slightly different relationship with a more-flat slope. These power relationships were linearized as:

Log (Wt) = 0.8874 log (BL) - 1.2343 with $R^2 = 0.2182$ for both sexes, log (Wt) = 0.5334log(BL) - 0.5738 ($R^2 = 0.0601$) for males, and log(Wt) = 1.0641log (BL) - 1.5662 ($R^2 = 0.3683$) for females (Figure 5).

Composition and diversity of prey community

The analyzed stomach contents from 100 individuals contained 315 prey items (161 in females, 125 in males and 29 in juveniles). The highest number of ingested prey per individual was observed in females; however, males consumed in total 42 prey species compared to 41 prey species in females. The average number of prey items per stomach was 2.7 ± 1.7 in adult females, 2.04 ± 1.04 in adult males, and 1.6 ± 0.5 in juveniles. The highest diversity values of prey were recorded in adult males (FNB = 18.8, H' = 5.4) followed by females (FNB = 12.7, H' = 5.3), then juveniles (FNB = 7.7, H' = 3.2).

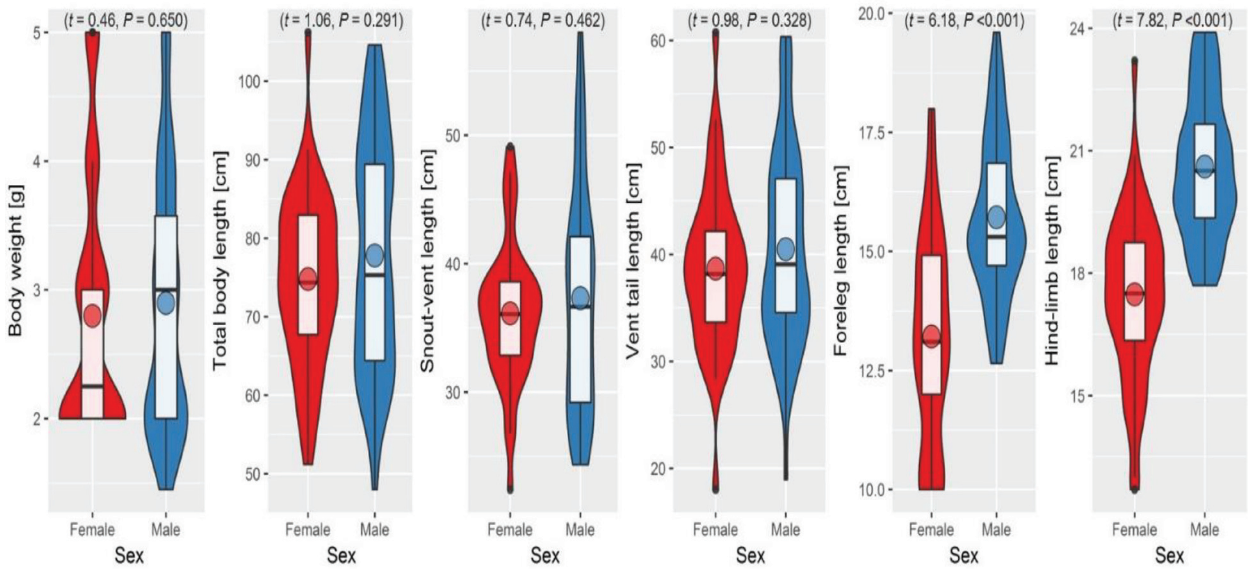

Figure 4. Morphometric traits of males and females of the Algerian wall gecko (*Tarentola neglecta*) from date palm groves in the Sahara Desert of Algeria. Coloured solid circles represent the means, and black circles are outliers. The statistics *t*- and *p*-values are results of linear models testing the variation of each trait between sexes.

The trophic niche overlap between sexes was 71%, and the numeric proportion of all prey occurring in the stomachs did not differ significantly between the sexes ($p = 0.44$). The sizes of prey populations were evenly distributed in the diet (E = 0.83–0.89) (Table 2).

Abundance and richness of prey categories

A total of 315 prey items were collected from 100 individuals using stomach-flushing, with an average of 2.5 ± 1.4 prey items per stomach. These prey were classified into three classes (Arachnida, Crustacea, and Insecta), 14 orders, 36 families and 47 genera. Overall, the food spectrum of *T. neglecta* consists of 14 prey categories at taxonomic order level, 12 observed in males, 10 in females and 7 in juveniles (Table 3). Insects represented the staple food of the AWG, with 303 individuals (PF = 96.19% of all counted prey individuals), followed by Arachnida class (PF = 2.85%). Among insects, the Diptera order occurred in the diet of 89 AWG individuals (45 adult females, 36 adult males, and 8 juveniles) with 15 prey species totalling PF = 28.3%. Hymenoptera prey totalled 83 individuals (PF = 33.1% with adult females, 27.6% juveniles, and 17.6% adult males) and 7 species; Coleoptera were present with 10 species and 55 individuals (PF = 17.5%) (Appendix 1). These three prey orders frequently occurred in the diet. The rest of categories presented PF by less than 6% for each. The dominant prey species in the diet of AWG adult females were *Pheidole pallidila* (PF = 18.6%), *Musca domestica*, PF = 15.5%, and *Anthicus* sp. (PF = 8.7%), whereas *M. domestica* (PF = 15.2%) and *Messor* sp. (PF = 9.6%) predominated in adult males. In juveniles' diet, *M. domestica* (PF = 24.1%) dominated.

Three classes of prey species were identified in the diet

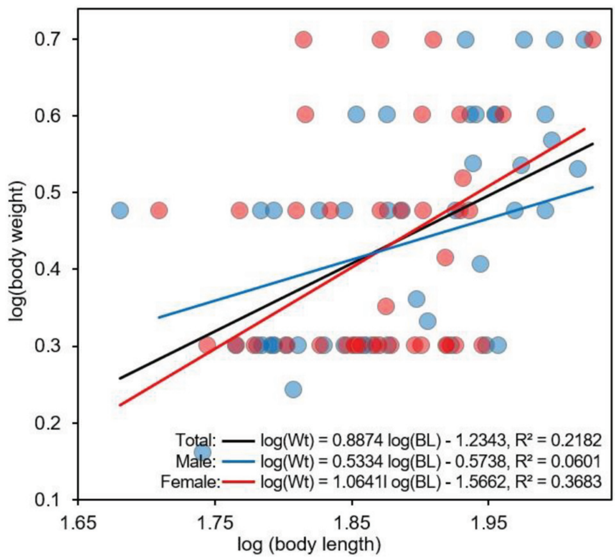

Figure 5. Relationship between total body length and body weight for adult males and adult females of the Algerian wall gecko (*Tarentola neglecta*) from date palm groves in the Sahara Desert of Algeria.

of *T. neglecta*. The first class consisted of highly rare prey and included 54 species, followed by the second class, which comprised rare prey represented by four species. The third class was represented by a single species, *Hemilepistus reaumuri* (Figure 6; Table 2). Besides the abundance data for *M. domestica*, this prey species is frequent and consistently present in the AWG diet. The occurrence frequency of *M. domestica* in the diet of females, males, and juveniles was 25.64%, and 29.79% (Table 3). Regarding prey volume (V_i) records, the most important prey items were *Mantis religio*35.7%, respectively*sa* (16.4%), *Blattela* sp. (9.5%), *Pyrgmorpha cognate* (5.9%), and *Gryllus* sp.

Table 2. Number of sampled geckos and diet characteristics (number of prey individuals, prey frequency, species richness, food niche breadth, Berger-Parker index, feeding niche overlap, Shannon diversity index, and evenness index) of the prey species identified in stomachs of *Tarentola neglecta* in the region of Oued-Souf, Algeria.

Diet characteristics		Females	Males	Juveniles	Total
Sample size (stomach-flushes)		39	47	14	100
Number of prey individuals 'N'		161	125	29	315
Prey frequency 'PF' (%)		51.1	39.7	9.2	100
Prey species richness 'SR'		41	42	11	59
Mean Sm per sample 'Sm'±SD		2.7 ± 1.7	2.04 ± 1.04	1.6 ± 0.5	2.5 ± 1.4
Food Niche Breadth 'FNB'		12.7	18.8	7.7	16.6
Berger-Parker index 'd'		0.19	0.15	0.24	0.16
Niche overlap 'O_{jk}'	Females	100	71	95	/
	Males	71	100	66	/
	Juveniles	95	66	100	/
Shannon diversity index 'H′'		4.7	4.8	3.2	4.9
H_{max}		5.3	5.4	3.8	5.9
Evenness 'E'		0.83	0.89	0.83	0.83

(5.4%). According to the index of relative importance (IRI), the most important prey item consumed was *M. domestica* (IRI = 496.4) (Table 3).

Distribution of prey size in the diet

The size of prey consumed by AWG varied across a wide range of length, ranging from 1.2 to 27 mm with a mean of 7.01 ± 5.6 mm. The distribution of prey size classes indicated that small-sized prey were the most consumed, with a clear dominance of prey measuring 4–8 mm in length (49.2% of individuals), followed by those measuring 0–4 mm (34.6% of individuals) (Figure 7). The Pearson's chi-squared test revealed a significant difference between the observed pattern in prey counts per prey sizes and the expected equal distribution of prey ($\chi^2 = 496.4$, df = 6, $p < 0.0001$).

Both prey volume and prey length increased significantly with the increase in SVL as shown by the linear regression for the effect of SVL on the variation of prey volume (F = 6.38, $p = 0.012$) and between SVL and prey length (F = 6.53, $p = 0.011$). However, the linear regression analysis revealed no significant relationship (F = 0.37, $p = 0.542$) between the number of prey items found in each stomach-flush of the AWG and its SVL (Figure 8).

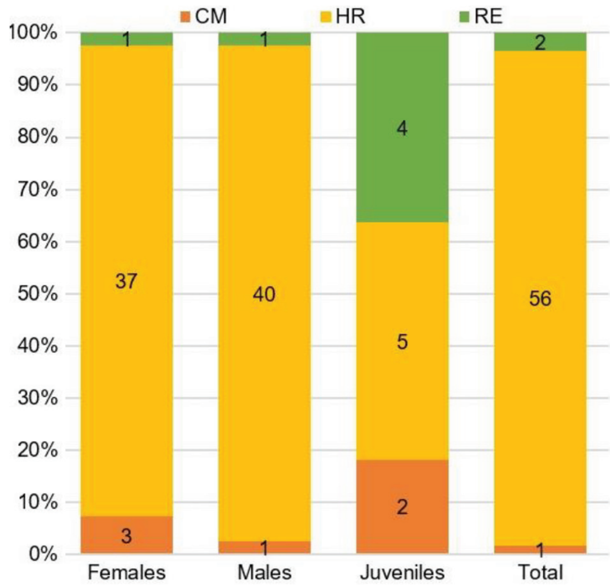

Figure 6. Occurrence frequencies and constancy scale (HR: highly rare prey, RE: rare prey, CM: common prey, CN: constant prey) of the different species ingested by *T. neglecta*.

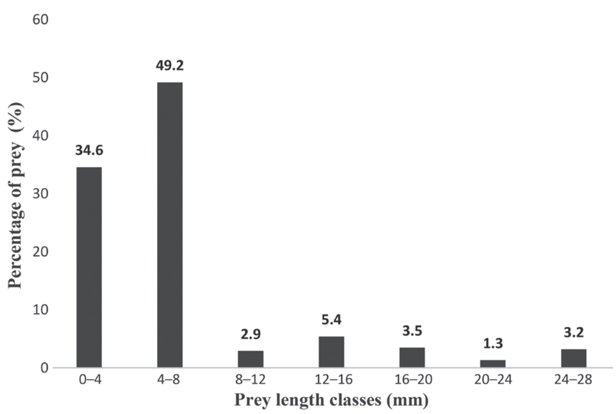

Figure 7. Distribution of prey counts in the diet of the Algerian wall gecko (*T. neglecta*) at Algerian Sahara Desert for different prey length classes.

DISCUSSION

This study examined the morphometrics and diet composition of AWG from date palm groves in the Algerian Sahara. The ecological diversity observed in lizards is closely linked to variation in traits such as body size, limb proportions, tail length and head dimensions (Norris et al. 2021). The maximum body (BL) of AWG in Oued-Souf is lower than that reported for North African populations (Le Berre 1989; Schleich et al. 1996; Trape et al. 2012) where the total length varied from 117 mm to 130 mm

Table 3. Number of individuals (n), frequencies of occurrence (Occ) and occurrence category (Occ Scale), prey frequency (PF), volumetric percentage (V%), and index of relative importance (IRI) in the diet of *T. neglecta* from date palm groves in the Sahara Desert of Algeria (HR: highly rare prey, RE: rare prey, CM: common prey, CN: constant prey).

Class: Order Family	Prey species	PF (%)	Females (n = 39)		PF (%)	Males (n = 47)		PF (%)	Juveniles (n =14)		PF (%)	Total (n = 100)		V (%)IRI	
			Occ (%)	Occ Scale		Occ (%)	Occ Scale		Occ (%)	Occ Scale		Occ (%)	Occ Scale		
Arachnida: Araneae															
Gnaphosidae	Species 1	1.86	5.13	HR	2.4	4.26	HR	–	–	–	1.9	4	HR	0.93	11.36
	Species 2	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	1.52	1.84
	Species 3	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	1.29	1.61
Arachnida: Acari															
Acari	Species	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	0.01	0.33
Order = 2; Family = 2; Prey species = 4															
Crustacea: Isopoda															
Agnaridae	*Hemilepistus reaumuri*	1.86	5.13	HR	–	–	–	–	–	–	0.95	2	HR	3.24	8.38
Order = 1; Family = 1; Prey species = 1															
Insecta: Dermaptera															
Forficulidae	*Anisolabis mauritanicus*	0. 62	2.56	HR	0.8	2.13	HR	–	–	–	0.63	2	HR	5.39	12.06
Labiduridae	*Labidurida reparia*	2.48	7.69	HR	4	10.64	HR		–	–	2.86	8	HR	2.64	0.22
	Labidura sp.	–	–	–	0.8	2.13	HR	–	–	–	0.3	1	HR	4.32	57.38
Dermaptera F ind	Species	–	–	–	3.2	6.38	HR	–	–	–	1.27	3	HR	2.11	10.15
Insecta: Blattoptera															
Blattidae	*Blattella* sp.	0.62	2.56	HR	1.6	4.26	HR	–	–	–	0.95	3	HR	9.52	31.41
	Species	–	–	–	1.6	4.26	HR	–	–	–	0.63	2	HR	1.73	4.72
Insecta: Mantodea															
Mantidae	*Mantis religiosa*	0.62	2.56	HR	–	–	–	–	–	–	0.32	1	HR	16.39	16.7
Insecta: Orthoptera															
Orthoptera F ind	Species 1	–	–	–	1.6	4.26	HR	–	–	–	0.63	2	HR	0.54	2.35
	Species 2	0.62	2.56	HR	4	10.64	HR	–	–	–	1.9	6	HR	3.37	31.66
Gryllidae	*Gryllus* sp.	–	–		0.8	2.13	HR	–	–	–	0.32	1	HR	5.39	5.71
Pyrgomorphidae	*Pyrgomorpha* sp.	0.62	2.56	HR	0.8	2.13	HR	–	–	–	0.63	2	HR	4.05	9.36
	Pyrgomorphacognata	0.62	2.56	HR	1.6	4.26	HR	–	–	–	0.95	2	HR	5.88	13.65
	pyrgomorphaconica	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	3.02	3.34
Insecta: Hemiptera															
Cydnidae	*Geotomus* sp.	1.24	5.13	HR	0.8	2.13	HR	13.79	28.57	CM	2.22	7	HR	0.06	16
Insecta: Hemiptera															
Aphididae	*Aphis* sp.	2.48	5.3	HR	4.8	6.38	HR	–	–	–	3.17	5	HR	0.06	16.15
	Aphis fabae	–	–	–	1.6	2.13	HR	–	–	–	0.63	1	HR	0.04	0.68
Jassidae	Species 1	2.48	7.69	HR	–	–		6.9	14.29	RE	1.9	5	HR	0.29	10.97
	Species 2	0.62	2.56	HR	1.6	2.13	HR	–	–	–	0.95	2	HR	0.13	2.16
	Species 3	0.62	2.56	HR	–	–		–	–	–	0.32	1	HR	0.19	0.51
Fulgoridae	Species	1.24	5.13	HR	–	–		–	–	–	0.63	2	HR	1.89	5.05
Insecta: Coleoptera															
Coleoptera F ind	Species 1	3.11	7.69	HR	4	8.51	HR	3.45	7.14	HR	3.49	8	HR	0.14	2.06
	Species 2	–	–	–	1.6	4.26	HR	–	–	–	0.63	2	HR	0.14	1.55
Anobiidae	Species	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	0.07	0.39
Aphodiidae	*Aphodius* sp.	1.86	7.69	HR	–	–	–	–	–	–	0.95	3	HR	2.7	10.95
Ptinidae	*Ptinus* sp.	0.62	2.56	HR	3.2	8.51	HR	6.9	14.29	RE	2.22	7	HR	0.11	16.31
Anthicidae	*Anthicus* sp.	8.7	25.64	CM	3.2	6.38	HR	6.9	7.14	HR	6.35	14	RE	0.93	101.84
Nitidulidae	*Carpophilus* sp.	1.24	5.13	HR	–	–	–	–	–	–	0.63	2	HR	0.24	1.74
Coccinellidae	*Coccinellidae* sp.	0.62	2.56	HR	0.8	2.13	HR	–	–	–	0.63	2	HR	0.05	1.36
Tenebirionidae	*Pimelia interstitialis*	2.48	7.69	HR	–	–	–	–	–	–	1.27	3	HR	5.05	18.96
	Dromius sp.	1.24	5.13	HR	0.8	2.13	HR	–	–	–	0.95	3	HR	0.68	4.9
Insecta: Hymenoptera															
Hymeneptera F ind	Species	1.24	5.13	HR	–	–		3.45	7.14	HR	0.95	3	HR	0.07	3.05
Formicidae	Species	1.24	5.13	HR	–	–	–	–	–	–	0.63	2	HR	0.07	1.42
	Messor sp.	3.11	10.26	HR	9.6	17.02	RE	–	–	–	5.4	12	HR	0.49	70.59
	Plagiolepis sp.	3.73	12.82	RE	2.4	4.26	HR	10.34	14.29	RE	3.81	9	HR	0.02	34.5
	Pheidole pallidula	18.63	33.33	CM	4.8	2.13	HR	13.79	7.14	HR	12.7	15	RE	0.13	192.42
	Monomoriun sp.	2.48	5.13	HR	0.8	2.13	HR	–	–	–	1.59	3	HR	0.17	5.28
	Tapinoma sp.	2.48	10.26	HR	–	–	–	–	–	–	1.27	4	HR	0.07	5.34

Class: Order Family	Prey species	PF (%)	Females (n = 39)		PF (%)	Males (n = 47)		PF (%)	Juveniles (n =14)		PF (%)	Total (n = 100)		V (%)IRI	
			Occ (%)	Occ Scale		Occ (%)	Occ Scale		Occ (%)	Occ Scale		Occ (%)	Occ Scale		
Insecta: Diptera															
Diptera F ind	Species 1	4.35	5.13	HR	2.4	6.38	HR	–	–	–	3.17	5	HR	0.06	16.15
	Species 2	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	0.14	0.46
Calliphoridae	*Calliphora erythrocephala*	0.62	2.56	HR	–	–		–	–	–	0.32	1	HR	2.97	3.28
	Lucilia sp.	1.24	5.13	HR	–	–		–	–	–	0.63	2	HR	3.24	7.74
Muscidae	Species	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	0.34	0.66
	Musca sp.	1.24	5.13	HR	1.6	4.26	HR	3.45	7.14	HR	1.59	5	HR	0.86	12.23
	Musca domestica	15.53	25.64	CM	15.2	29.79	CM	24.14	35.71	CM	16.19	29	CM	0.93	496.36
Drosophilidae	*Drosophila* sp.	–	–	–	1.6	0.26	HR	–	–	–	0.63	2	HR	0.31	1.9
	Drosophila melanogaster	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	0.06	0.38
Syrphidae	*Syritta* sp.	0.62	2.56	HR	–	–	–	–	–	–	0.32	1	HR	0.13	0.45
Sciomyzidae	*Trypetotera* sp.	–	–	–	0.8	2.13	HR	–	–	–	0.32	1	HR	0.27	0.59
Tephritidae	Species	1.86	7.69	HR	–	–	–	–	–	–	0.95	3	HR	0.34	3.87
	Ceratitis capitata	0.62	2.56	HR	–	–	–	–	–	–	0.32	1	HR	0.66	0.98
Agromyzidae	Species	0.62	2.56	HR	–	–	–	–	–	–	0.32	1	HR	0.13	0.45
Culcidae	*Culex* sp.	1.24	5.13	HR	4.8	2.13	HR	–	–	–	2.54	3	HR	0.01	7.64
Insecta: Lepidoptera															
Lycaenidae	Species	0.62	2.56	HR	2.4	6.38	HR	6.9	14.29	RE	1.9	6	HR	4.14	36.29
Insecta: Neuroptera															
Neuroptera F. ind	Species	–	–	–	1.6	4.26	HR	–	–	–	0.63	2	HR	0.3	1.87
Order = 11; Family = 33; Prey species = 54															

(Le Berre 1989; Schleich et al. 1996; Joger 2003; Trape et al. 2012; Mouane et al. 2020).

The maximum scores of SVL for males (58–59 mm) and females (50–51 mm) reported in previous studies (Schleich et al.1996; Bshaena and Joger 2013) closely aligns with the morphological data from this study, where the maximum SVL was 58 mm for males and 49 mm for females. Our findings regarding forelimb length (FLL) and hindlimb length (HLL) in the study area are consistent with measurements from other locations within the species range (Bshaena and Joger 2013; Mouane 2020; Mouane et al. 2020, 2021). In these studies, forelimb length averaged 14 ± 0.2 mm; while hindlmb length was 18 ± 0.2 mm (Mouane et al. 2020). The snout-vent length did not show significant variation between sexes, which is in agreement with findings in other populations of similar lizard species (Church 1962; Sabath 1981; Klawinski et al. 1994; Saenz 1996; Bonfiglio et al. 2006; Iturriaga and Marrero 2013; Mouane et al. 2021). This contrasts with other studies on species like *Anolis polylepis* (Iguania) where males *A. polylepis* were found to be significantly larger and heavier than females (Perry 1996).

Of the 121 AWG specimens captured, 21 geckos (17.4%) had no stomach content, a finding consistent with Bonfiglio et al. (2006) and Loveridge (1947). Huey et al. (2001) note that nocturnal lizards often have a higher proportion of individuals with empty stomachs (more than 20%) when compared to diurnal species. The AWG in Oued-Souf exhibited a highly diverse diet comprising 59 prey species, all of which were arthropods, predominately small-sized (< 8 mm) species. Insects were the most frequently consumed prey while Araneae were the second important food category in the diet in terms of number and frequency. In general, the analysis of diet composition and diversity indicated that this species is a generalist and opportunistic feeder.

Herpetologists agree that lizards are highly adaptable predators with a diverse diet, feeding on various organisms (Avery 1966; Greene 1982; Arnold 1987). Since insects are the most common and abundant prey in the AWG diet, our finding aligns with the previous studies reporting that AWG is generally insectivorous (Schleich et al. 1996; Trape et al. 2012).

The mean number of prey items (Sm) consumed by adult males, adult females and juveniles of the AWG collected in south-eastern Algeria is comparable to that of another gecko (*Hemidactylus mabouia*) studied in Havana, Cuba (Iturriaga and Marrero 2013). Regarding the feeding niche breadth, our findings are similar to those of Shterbak (1966) for *Gymnodactylus kotschyi* in Crimea, where the FNB was calculated to be 11.19 based on their data. Adult males appear to occupy the widest trophic niche breadth among the three age/sex classes, indicating greater dietary flexibility and adaptability. This adaptability may be attributed to factors such as physiological traits (body size), foraging behaviour, and competitive interactions. Adult males might be more opportunistic in their feeding habits, utilizing a broader range of food resources available within their habitat (Schleich et al. 1996; Drüke and Rödder 2017).

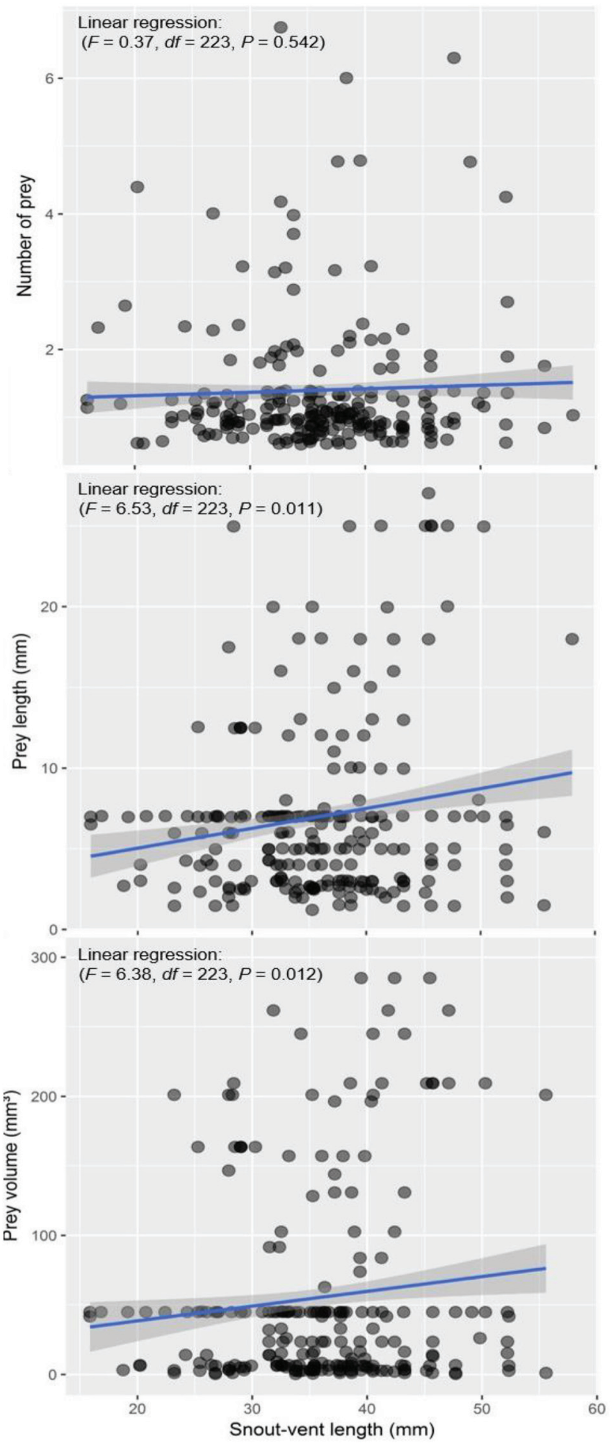

Figure 8. Relation between snout-vent length of the Algerian wall gecko (*Tarentola neglecta*) and prey abundance (upper plot), prey length (centre plot), and prey volume (lower plot). The solid lines represent linear regressions obtained by a linear model fit with confidence regions in light grey.

A high dietary composition overlap (Ojk = 71%) between adult AWG individuals can be explained by the high availability of insect prey in the palm grove. According to Hebbaz (2009) and Hadjoudj (2018), the palm grove functions as a real forest-like environment with a favourable mesoclimate for arthropods. Additionally, both adult sexes employ similar foraging strategies and habits. The abundance of prey in both urban and natural environments reduces food resource competition among individuals of the same species (Colli et al. 2003; Hibbitts et al. 2005; Bonfiglio et al. 2006). The substantial overlap in diet composition between adult females and juveniles (Ojk = 95%) aligns with findings by Rocha and Anjos (2007) and Drüke and Rödder (2017).

This study found that Diptera, Hymenoptera and Coleopterataxa were the most significant prey items in the diet of AWG. In date palm groves of Oued-Souf, Hymenoptera, Diptera and Coleoptera are also reported as the most abundant invertebrate taxa (Aouimeur et al. 2017; Hadjoudj 2018). Flies, beetles, ants, and moths are commonly important components in the diets of generalist geckos (Bustard 1968; Bonfiglio et al. 2006; Mollov and Boyadzhiev 2018; Cyriac and Umesh 2021). This could be due to the physiological state of the predator, as AWG performance appears to improve with higher prey density. Furthermore, abiotic factors, especially temperature, may affect selective predatory efficiency (Mahmoudi et al. 2022). Several studies (e.g. Bonfiglio et al. 2006; Iturriaga and Marrero 2013) have found no significant positive correlation between predator size (SVL) and prey traits (numbers, volume and length). This is partially in agreement with our study, which also found no significant relationship between SVL and the number of prey ($p > 0.05$. However, our findings indicated that there are significant relationships between AWG size and the size of consumed prey, where both prey length and prey volume tend to increase with the increase in gecko SVL (t = 2.52, $p = 0.012$).

CONCLUSION

The diet of the Algerian wall gecko in date palm groves of Oued-Souf consists exclusively of arthropods, mainly small-sized Diptera, Hymenoptera and Coleoptera. There is no significant difference in diet composition and diversity between adult males and females. Both prey size and prey volume tend to increase accordingly. While our study provides insights into prey types foraged by the Algerian wall gecko in this specific habitat, it does not offer detailed information on prey selection across different environments. Further research is needed to understand its foraging behaviour in various habitats as well as across different seasons.

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Authors' contributions

The original concept for the study was developed by MA, with AH and KR contributing to the setup. AH and KR conducted sample collection under AM's supervision, while CH and AA performed the statistical analysis. All authors wrote the manuscript, approved the final version, and consented to publication.

Competing interests

All authors declare that they have no competing interests.

Availability of data and materials

Data and materials will be made available on request.

Consent for publication

All the authors consent to the publication of this manuscript.

Ethics approval consent to participate

This study was conducted in accordance with ethical standards for research involving animals.

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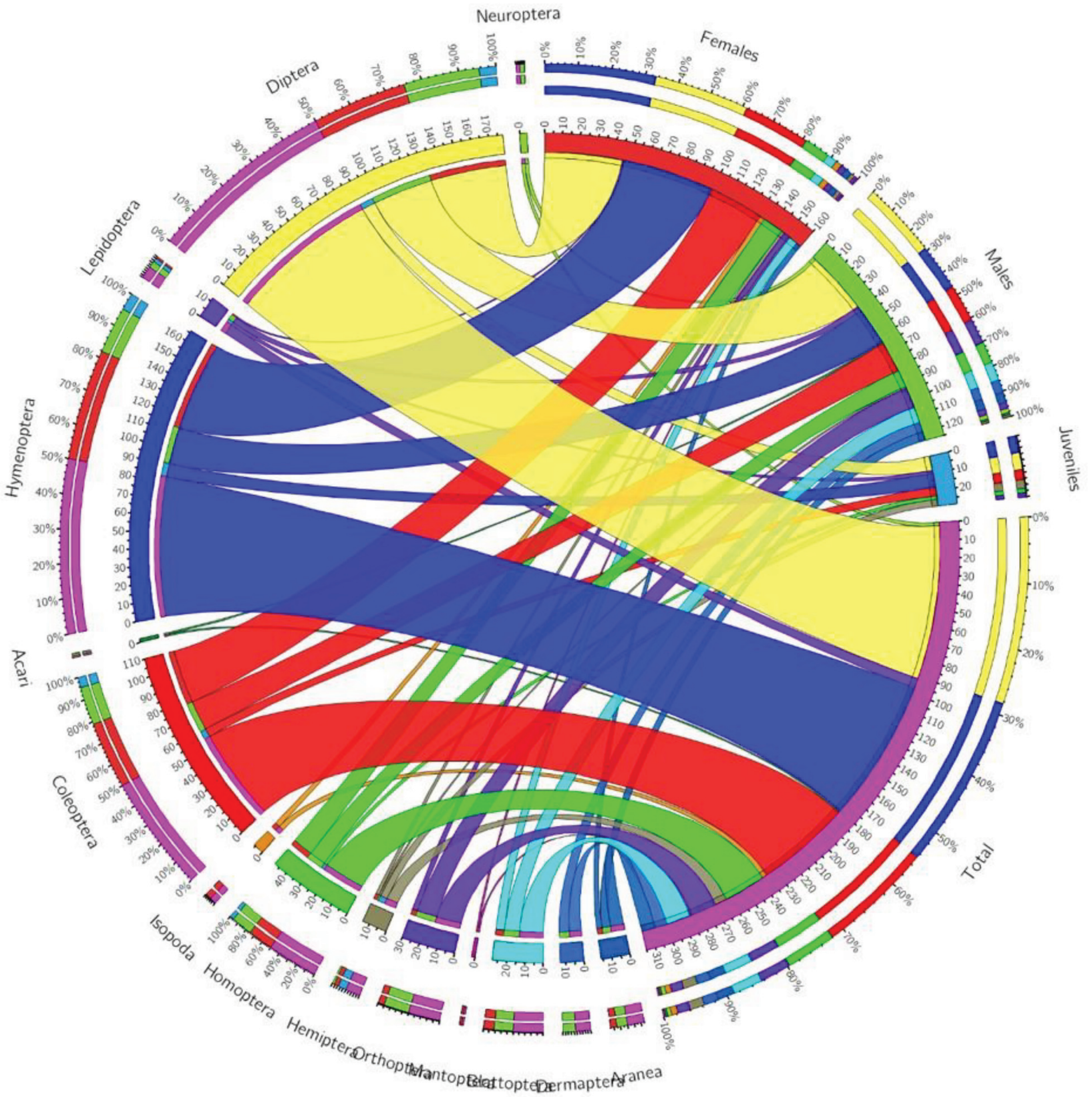

Appendix 1. Cord diagram displaying abundance-based distribution of prey order identified for of males, females and juveniles of the Algerian wall gecko (*Tarentola neglecta*) from date palm groves in the Sahara Desert of Algeria.