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HABITAT USE AND FOOD HABITS OF A GECKO POPULATION IN A WEST AFRICAN SUBURBAN AREA

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Abstract.

1. *The spatial and trophic ecology of Afrotropical gecko populations are poorly known. Here, we report ecological observations on Brook's House Gecko (Hemidactylus angulatus), a widespread gekkonid species, in the Rivers State University of Science and Technology campus, Port Harcourt, Nigeria.*
2. *A total of 488 gecko individuals were recorded during the present study, in two surveyed habitat types: (i) plantation trees (PTH) and (ii) buildings (BDH). In PTH, they were observed in 13 out of 15 species of trees present in the study area, with their (log) frequency of sightings being positively correlated to the (log) frequency of surveyed trees per species.*
3. *The geckos used substantially the non-native ornamental trees of the PTH habitat. Pinus ponderosa and Elaeis guineensis were significantly preferred by geckos over all the other tree species.*
4. *Geckos also used frequently the buildings (BDH habitat) at the university campus. There was no correlation between (log) area of each building and (log) number of observed lizards.*
5. *We collected faeces from 51 gecko individuals in dry season and 66 in wet season. There were no significant dietary differences between seasons, with Diptera and adult Lepidoptera dominating in the diet.*
6. *Dietary habits of geckos differed significantly between habitat types, with Araneae and Lepidoptera (larvae) being eaten much more frequently in BDH, and in Coleoptera and Isopoda that were eaten much more frequently in PTH The diversity dietary metrics (Shannon and Dominance indices) were very similar either between seasons or between habitats.*
7. *Our independent set of analyses (diet diversity metrics; contingency tables on taxonomic dietary composition and rank-abundance diagrams) showed that lizards exhibited a same feeding strategy in both wet and dry seasons as well as in the two habitat types, although the diet composition differed significantly between habitats.*
8. *A "mixed" foraging strategy was apparently used by Hemidactylus angulatus at the study area, as also observed in other gekkonid species from elsewhere.*

Key words: Habitat; diet; suburban; Brook's House Gecko; West Africa.

Introduction

Geckos are among the most speciose and ecologically plastic reptiles on earth, with several species being adapted to urban and suburban environments (Rösler 1995; Bauer 2013). However, at least in the African tropical regions, their ecology has been studied mostly in natural habitats, including forested and savannah habitats (e.g., Cole 2005; Luiselli et al. 2007; Rugiero et al. 2007; Cole and Harris 2011), whereas fewer studies were carried out in urban habitats (but see Avery 1980; Gramentz 2000). Nonetheless, several university campus in West Africa still include small forested patches and/or replanted areas that furnish a good environmental context for gecko populations. These populations are interesting to study in order to learn more about the ecological strategies of these lizards in rapidly changing environments, and especially in relation to the exotic plant species that are often introduced as ornamental tools in these artificial environments. Indeed, since the spread of invasive plants poses a serious threat to the composition, structure, and function of biotic communities worldwide (e.g. Simberloff 2005, 2006; Shine 2010), it is interesting to investigate how native animals can adapt to use invasive plants as living spaces. Native lizard species can be disturbed by the presence of invasive plants and may avoid alien plants for various reasons: for instance, because the exotic plants may cause different microhabitat temperatures than those preferred by the species during peak activity; or because the native habitat contains higher richness of preferred prey items than the exotic habitat; or even because mimicry is reduced in the exotic microhabitats (Valentine et al. 2007). However, in at least some cases, it has been demonstrated that lizards may benefit from using invasive plants: for instance, a *Calotes* species from Sri Lanka use habitats non-randomly and prefer the invasive *Ulex* bushes over native vegetation in disturbed habitats due to reduced predator risk and increased foraging benefits (Somaweera et al. 2012).

One of these still biodiversity-rich suburban areas that is heavily impacted by the presence of exotic plant species (= ornamental trees) is, in southern Nigeria, the campus of the Rivers State University of Science and Technology, situated in the Port Harcourt (Nkpolu Oroworukwo community land). Prior to 1972, this was a typically deltaic swamp forest of the Niger Delta, with a rich assemblage of both flora and fauna (e.g., Amadi 2017; Alawa 2018). The building of the campus, as well as the huge development of the metropolitan area (now Port Harcourt is the largest city of the whole region), resulted in extensive deforestation and alteration of the original plant species, that presumably also affected and altered substantially the resident animal communities. Many species of ornamental trees, mainly of non-native origin, were planted throughout the Port Harcourt metropolitan area, that is now one of the "greenest" cities in Nigeria being even known as the "garden city" (Alawa 2018). In order to mitigate the ecological consequences of the collapse of native flora would have on surviving organisms, many exotic' ornamental trees (e.g. *Pinus*, *Eucalyptus*, *Jacaranda*, and *Terminalia* spp) were also planted in the university campus (Alawa 2018), and today even a few species of conservation concern (e.g., the Critically Endangered vulture *Necrosyrtes monachus*) still reside with the stands of *Terminalia ivoriensis* trees of the Rivers State University Campus (Alawa 2018).

In this paper, we report ecological observations on the Brook's House Gecko (*Hemidactylus angulatus*, a widespread gekkonid species that occurs from Senegal to Angola (Trape et al. 2012). This is a savannah species that spends most of its activity time under the bark of trees (Trape et al. 2012). However, *Hemidactylus angulatus* also frequently inhabits human settlements and urban areas (Romer 1953; Sura 1987; Powell and Maxey 1990; Akani et al. 1999). Quantitative ecological traits of *Hemidactylus angulatus* are still relatively understudied, with most available ecological data referring to *Hemidactylus brooki*, of which *angulatus* was till recently considered a subspecies (Rösler and Glaw 2010). More specifically, here we focus on (i) habitat usage, (ii) eventual preference for native versus planted alien trees as a presence habitat, and (iii) food habits of the gecko population inhabiting the campus of the Rivers State University of Science and Technology.

1. Materials and Methods

1.1. Study area

The field study was carried out in the campus of the Rivers State University of Science and Technology (04^0 47.7725'N; $006^0$58.7526'E), Port Harcourt Local Government Area of Rivers State, Nigeria. The area has wet tropical climate, with a temperature average of 25-28^0 C and with precipitation from April to September and dry season from October to March (Amadi 2017). The study area was chosen because it is one of the easily accessible areas with a large assemblage of trees in Port Harcourt Local Government Area, thus allowing nocturnal ecological work.

1.2. Protocol

For studying habitat usage by the study species, field data were collected from June through August 2018. Two distinct habitat types available to geckos were defined: (i) plantation trees (PTH) and (ii) buildings (BDH), situated in the surroundings of the faculties of Engineering, Technical/ Science Education and Sciences (building habitat), and in the surroundings of the university gate through the love garden to the staff club (overall, 60.34 ha). PTH was mainly English-style lawn dominated by planted ornamental trees, including *Eucalyptus* sp., *Mangifera indica*, *Elaeis guineensis*, *Terminalia catappa, T.superba, T.mantaly, Pinus ponderosa, P. caribaea,* and *Jacaranda* sp. (Amadi 2017). Tree species richness (n=15) was dominated by the Ponderosa pine (*Pinus ponderosa*) , and 13 out of 15 species of trees were not native (Table 1). BDH included only the cement-made build-

Table 1. Distribution of the number of observed *Hemidactylus angulatus* across tree species in the PTH habitat**.**

Tree common name	Tree species	No. of trees	No. of Geckos	Ratio No. geckos/No. Trees
African oil palm	*Elaeis guineensis*	11	31	2.82
Gum trees	*Eucalyptus sp.*	2	0	0.00
Melina	*Gmelina arborea*	23	21	0.91
Jacaranda	*Jacaranda mimosifolia*	16	23	1.44
Mango	*Mangifera indica*	2	0	0.00
Avocado	*Persea americana*	2	4	2.00
Caribbean pine	*Pinus caribaea*	29	27	0.93
Ponderosa pine	*Pinus ponderosa*	79	230	2.91
Masquerade tree	*Polyalthia longifolia*	15	20	1.33
Guava	*Psidium guajava*	1	1	1.00
Teak	*Tectona grandis*	1	2	2.00
Indian almond	*Terminalia catappa*	3	3	1.00
Black afara	*Terminalia ivorensis*	7	5	0.71
Umbrella tree	*Terminalia mantaly*	3	1	0.33
White afara	*Terminalia superba*	6	9	1.50
TOTAL		200	377	

ings and their walls. The ground is also paved with cement. In each of the surveyed habitat, we walked a transect of 1.86 km on each sampling date, spending also an identical effort time by habitat type (overall, 15 man-hours per sampling, during five nights at each site). In each of the two studied habitats, gecko presence and abundance were studied by slowly exploring the study spots from 19:00 to 22:00 hours, using flashlights from four Tecno Camon C8 mobile phones. We searched for lizards around buildings and trees, carefully moving around the investigated habitats and flashing our lights from top to bottom of the buildings and trees until all visible geckos were recorded, and carefully avoiding to re-survey the same cement wall in order to minimize the risk of pseudo-replication biases. In all survey cases of both trees and buildings, two persons were engaged to do the work, with a third person standing at a point preventing any previously counted geckos to be mistakenly recounted. Since the study was conducted only at night, the buildings were locked up, so we were only able to survey the external parts of the buildings. We recorded the exposure towards North, South, West and East, of the walls of each lizard that was observed during the present study. We also recorded the substratum temperature (to ± 0.1°C precision; with an electronic thermometer) of the wall surface at several points where gecko individuals were observed. We surveyed each building only once. We carefully surveyed and counted all the visible geckos on a given tree and then moved to the next tree, but we never counted geckos on a tree twice as (i) we never re-examined a same tree after the first survey, and (ii) we were careful, during the single survey made at each tree, to visually monitor the observed individuals in order to avoid multiple counts of a same gecko. Overall, a total of 200 tree stands from 15 species, as well as 20 buildings, were accurately surveyed for the presence of the target species (Tables 1 and 2).

Buildings' entire surfaces were measured by using the architectural maps of the university campus.

Food habits were studied over 60 days of field research (30 in dry season, January-February 2015; 30 in wet season, June-July 2015). Lizards were captured by hand and were individually kept in small bags until defecation occurred. After that, they were released at the capture point. The diets of the captured individuals were studied by analyzing faecal pellets using standard laboratory methods (Luiselli et al. 2011; Pérez-Mellado et al. 2011). The various prey type items were recorded as present/absent in each analyzed faeces. We avoided counting the total number of prey items within each type category in each faeces, because this procedure likely produces biases using faecal content methodology due to fragmentation and partial digestion of prey items. Whereas we divided the diet samples by season (wet versus dry) for analysing the whole dietary spectrum of the study species, when we analysed the diet composition by habitat type (i.e. PTH versus BDH) we were forced to sum the samples collected during both wet and dry seasons in order to achieve a reliable sample size.

1.3. Statistical analyses

Two indices of dietary diversity were calculated for both dry and wet seasons, as well as for the two types of habitat:

(i) Shannon index, which varies from 0 for seasons with only a single eaten taxon to high values for seasons with many taxa, each with few individuals (Hammer 2012).

(ii) Dominance index, ranging from 0 (all taxa are equally present) to 1 (one taxon dominates in the diet completely) (Magurran 1988).

Sample rarefaction was assessed, for both seasons as well as for both habitat types, on a matrix of presence-absence data of each prey type in each gecko individual, with taxa in rows and samples in columns. Sample-based rarefaction (or species accumulation curve) was implemented using the analytical solution known as "Mao's tau," with Standard Deviation (Colwell et al. 2004). In the graphical plot, the standard errors were converted to 95% confidence intervals. Confidence intervals were generated by 9999 bootstraps. We used a normal quantile plot to confirm that the bootstrap distribution was nearly normal in shape (Hesterberg 2011)

Rank-abundance curves were used to compare the structure of the arthropod community eaten by the lizards by season and by habitat type. If the curves obtained for both habitats are similar, that means that lizards do not select for habitat for different probability to find a given prey species. Or, they do select, but to obtain the same prey composition, they have to apply a different hunting effort/strategy. Rank-abundance curves by season and by habitat type were statistically compared using one-way ANCOVA (Battisti et al. 2008, 2009). The differences in the median number of lizards among the various tree species was evaluated by Kruskal-Wallis ANOVA.

All variables were tested for normality and homoscedasticity by Shapiro-Wilk test, and when non-normal ($P < 0.05$), they were log-transformed. In order to evaluate whether the lizards used the planted trees in relation to their availability in the environment, we correlated the (log) number of observed individuals per tree with the (log) number of surveyed trees of each species by Pearson's correlation coefficient. In order to evaluate the differences in the mean substratum temperatures at several sites of gecko sighting between the two habitat types, we performed a Student t-test. Dietary differences in the frequencies of prey types by season and by habitat were evaluated by contingency tables χ^2 test. Data is presented as Mean ± *1 Standard Deviation.*

2. Results

2.1. Habitat usage

A total of 377 geckos were recorded in PTH, and 111 in BDH (overall $n = 488$; frequency differences: $\chi^2=78.3$, $df = 1$, $P < 0.0001$). Concerning PTH, the lizards were observed on 13 of 15 species of trees (Table 1), and the (log) number of observed individuals was positively correlated with the (log) frequency of surveyed trees per species ($r = 0.615$, n = 15, $P < 0.05$; Figure 1). In other words, the higher the number of planted trees of a given species in the environ-

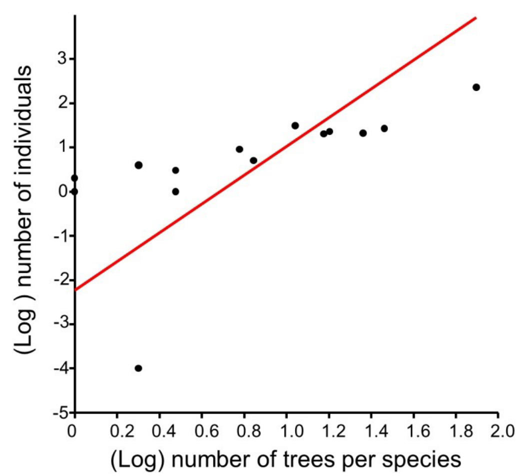

Figure 1. Relationship between (log) number of surveyed trees per species and (log) number of observed *Hemidactylus angulatus*. For statistical details, see the text.

Table 2. Descriptive statistics for the number of *Hemidactylus angulatus* individuals found in each species of tree at the Rivers State University of Science and Technology campus.

Species	Min	Max	Mean	Standard deviation	Median
Elaeis guineensis	1	5	3.1	1.45	3
Gmelina arborea	0	2	1.04	0.84	1
Eucalyptus sp.	0	0	0	0	0
Jacaranda mimosifolia	0	5	1.53	1.68	1
Mangifera indica	0	0	0	0	0
Persea americana	0	2	1	0.82	1
Pinus caribaea	0	4	0.96	1.14	1
Pinus ponderosa	0	17	2.91	3.39	2
Polyalthia longifolia	0	4	1.33	1.40	1
Psidium guajava	1	1	1	0	1
Tectona grandis	2	2	2	0	2
Terminalia catappa	0	3	1	1.73	0
Terminalia ivorensis	0	3	0.71	1.11	0
Terminalia mantaly	3	3	3	0	3
Terminalia superba	0	3	1.12	1.12	1

ment the higher the number of lizards using them. The mean number of lizards per tree was 1.38 ± 0.98 (*n* = 15; range 0-17) (Table 2), with the highest number of lizards per tree being found in *Pinus ponderosa* and in *Elaeis guineensis*. The median number of lizards per tree species differed significantly among the various tree species (Kruskal-Wallis ANOVA: H = 29.98, H_c (tie corrected) = 31.72, P < 0.01), and Mann-Whitney pairwise tests showed that *Pinus ponderosa* and *Elaeis guineensis* were significantly preferred by geckos over all the other tree species.

In BDH habitat, 41 (36.9%) individuals were recorded within 1m radius from an artificial light source. The majority of individuals (42.4%) was observed in walls exposed to South, 31.3% to East, 21.2% to West, and only 17.2% to North. There was no correlation between (log) area of each building and (log) number of observed lizards (*r* = 0.321, n = 20, *P* = 0.168; Table 3). The mean observed density was 0.005 ± 0.005 individuals per m^2 (*n* = 20, range 0-0.019). Eggs were observed only in the PTH habitat, inside small holes of trees and under the tree bark (Plate 1).

The recorded substratum temperatures at several sites of gecko sighting (Appendix 1) were significantly higher in BDH (x = 34.5 ± 2.6°C) than in PTH (x = 32.5 ± 0.6°C) (Student t-test, t = 4.85, df = 38, P < 0.0001).

Plate 1. Eggs of *Hemidactylus angulatus* deposited inside a small tree hole in the BDH habitat at the Rivers State University of Science and Technology campus, Port Harcourt.

Table 3. Distribution of the number of observed *Hemidactylus angulatus* across surveyed buildings in the BDH habitat.

Building	Area (m^2)	No. of lizards
TET Fund	1462.46	3
Food Science	1400.61	3
Medical Laboratory Science	1952.4	2
Biology Laboratory	949.06	3
Science	1591.64	1
ETF	720.56	2
Chemistry Laboratory	599.24	0
Physics Laboratory	979.68	2
Mathematics and Computer Science Office	211.84	4
New Faculty of Technical and Science Education	2776.18	4
Civil Engineering workshop	531.36	4
Marine Engineering workshop	542.02	6
Electrical Engineering workshop	2617.16	5
Chemical Engineering workshop	786.92	3
Petroleum Engineering workshop	2160.13	8
EDH	1495.84	14
Lecture Theatre	1531.36	12
Faculty of Engineering Office Complex	5281.25	15
Ecobank/SUG Parliament	1876.7	13
Mechanical Engineering workshop	1944.61	7

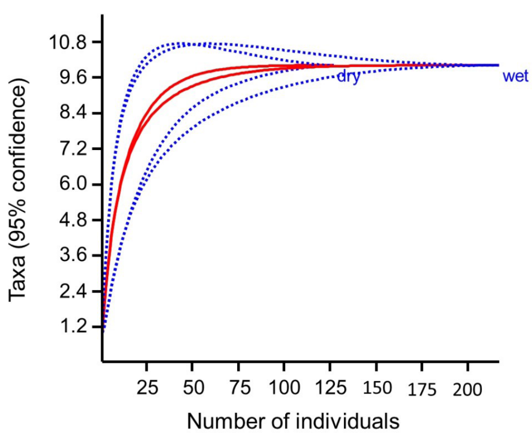

Figure 2: Saturation curves (red thin curves) and upper and lower confidence intervals, after 9,999 bootstraps (blue dotted curves) of the taxonomical diet composition of *Hemidactylus angulatus* in Port Harcourt, by dry season and wet season. Symbols: dry = dry season; wet = wet season.

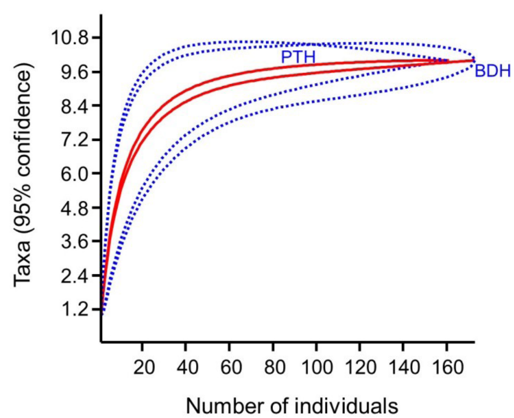

Figure 3: Saturation curves (red thin curves) and upper and lower confidence intervals, after 9,999 bootstraps (blue dotted curves) of the taxonomical diet composition of *Hemidactylus angulatus* in Port Harcourt, by habitat type. Symbols: PTH = plantation trees; BDH = buildings.

2.2. Food habits

2.2.1. *Seasonal dietary variations*

Overall, we collected faeces from 51 geckos in the dry season and 66 in the wet season (Table 4). Ten food categories were identified from the faeces, with Diptera and adult Lepidoptera dominating the diet both in dry and in wet seasons, and Formicoidea also accounting numerically for a substantial dietary component during the wet season. The frequencies of prey types eaten did not vary significantly between seasons (χ^2 = 15.3, df = 9, P = 0.082).Individual rarefaction curve revealed that a plateau phase was reached for both seasons (Figure 2), and therefore the taxonomic composition of the diet was accurately described by our samples. The diversity indices were very similar between seasons: Shannon index varied from 2.060 (dry season) to 2.065 (wet season), and dominance index varied from 0.154 to 0.148.

2.2.2. *Interhabitat dietary variations*.

Overall, we collected faeces from 59 geckos in PTH and 58 in BDH (Table 4). Individual rarefaction curve revealed that a plateau phase was reached for both habitats (Figure 3). The number of different prey types was very similar between habitats: ten in PTH versus nine in BDH (Table 4). The frequencies of prey types eaten were significantly different between habitats (χ^2 = 63.4, df = 9, P < 0.0001). The main differences were in Araneae and Lepidoptera (larvae) being eaten much more frequently in BDH, and in Coleoptera and Isopoda that were eaten much more frequently in PTH (Table 5). The diversity indices were very similar between habitats: Shannon index varied from 2.043 (PTH) to 2.114 (BDH), and dominance index varied from 0.153 to 0.183. Rank-abundance trajectories were not statistically different neither by season (one-way ANCOVA: $F_{1,17}$ = 2.34, P = 0.145) (Figure 4a) nor by habitat type (one-way ANCOVA: $F_{1,17}$= 0.10, P = 0.760) (Figure 4b).

3. Discussion

3.1. Habitat usage

Although geckos were apparently less common in BDH in respect to PTH, it should be considered that the methods of detection and the probability of detection of each individual was certainly different, and may be even incomparable, between habitats. Moreover, we did not control for the surface of lizards' habitat and we do not know if the surface of the trees is similar to the surface of the walls. Thus, we cannot be sure whether the number of individuals is really underrepresented in BDH. In PTH, the geckos exhibited a preference for the oil palm tree and for *Pinus*

Table 4. Synopsis of the diet data obtained from feces of 51 gecko individuals in dry season and 66 in wet season. Numbers would indicate the number of *Hemidactylus angulatus* individuals containing a given prey item and not the number of food items.

	dry season	% in stomach	wet season	% in stomach
Arachnida				
Araneae	9	17.65	14	21.21
Crustacea				
Isopoda	7	13.73	16	24.24
Insecta				
Blattodea	11	21.57	23	34.85
Coleoptera	6	11.76	18	27.27
Diptera	32	62.75	41	62.12
Hymenoptera Vespoidea	8	15.69	7	10.61
Hymenoptera Formicoidea	17	33.33	38	57.58
Lepidoptera (adults)	28	54.90	49	74.24
Lepidoptera (larvae)	6	11.76	4	6.06
Myriapoda				
Chilopoda	3	5.88	7	10.61

Table 5. Synopsis of the diet data obtained from feces of 59 *Hemidactylus angulatus* individuals in the habitat PTH and 58 in the habitat BDH. Numbers would indicate the number of lizard individuals containing a given prey item and not the number of food items.

	PTH	% in stomach	BDH	% in stomach
Arachnida				
Araneae	2	3.39	21	31.82
Crustacea				
Isopoda	14	23.73	9	13.64
Insecta				
Blattodea	10	16.95	14	21.21
Coleoptera	18	30.51	6	9.09
Diptera	40	67.80	33	50.00
Hymenoptera Vespoidea	7	11.86	8	12.12
Hymenoptera Formicoidea	30	50.85	25	37.88
Lepidoptera (adults)	26	44.07	51	77.27
Lepidoptera (larvae)	5	8.47	5	7.58
Myriapoda				
Chilopoda	9	15.25	0	0

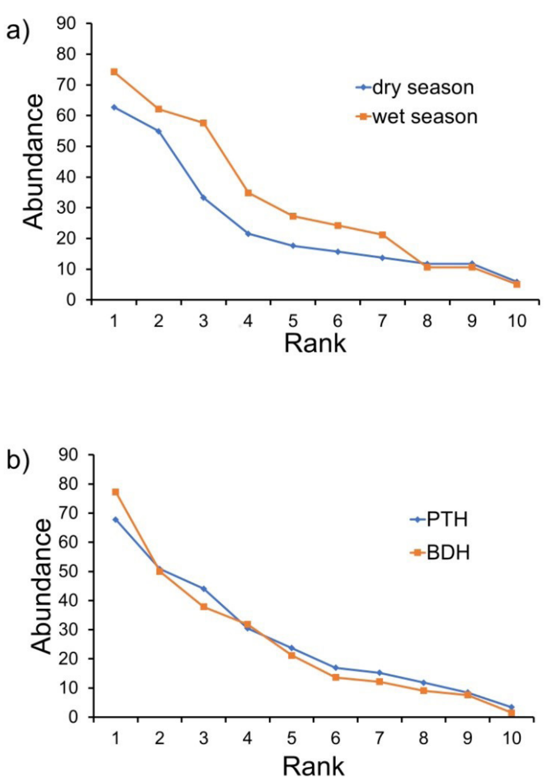

Figure 4. Rank-abundance curves for the diet habits of *Hemidactylus angulatus* by season (graphic a)) and habitat type (graphic b)). For statistical details, see the text. Symbols: PTH = plantation trees; BDH = buildings.

ponderosa, an invasive species from the Americas. Our study cannot uncover the reasons behind these habitat preferences, and further ad-hoc experiments should be made in order to stress firm conclusions in this issue. Anyway, it seems that our gecko population may benefit from the planted alien trees, similarly to other lizard species studied so far (Somaweera et al. 2012).

We observed a high percentage of gecko individuals nearby (< 1 m distance from) artificial lights. Thus, it is clear that artificial lights represent an important “landscape element” of BDH habitat for these lizards. Artificial walls may constitute a suitable surrogate of natural habitat for geckos, especially for foraging because of the attraction of insects to the artificial lights around the buildings (e.g., Luiselli and Capizzi 1999). Many nocturnal lizard species, especially members of the family Gekkonidae, have also been documented around night lights (Perry et al., 2008). Presumably, the concentration of invertebrates around artificial lights attracts lizards because of the greater availability of prey that are easy to catch (Capula and Luiselli 1994). In our study case, we found the same number of prey categories in the lizard guts in both habitats, and therefore the above-mentioned hypothesis was rejected in terms of prey type diversity. However, it remains well possible that at least some of the prey categories may be more abundant/concentrated around artificial lights at night. This might be the case for adult moths (order Lepidoptera) that are well known to be attracted by artificial nocturnal lights (Eisenbeis et al. 2006; Van Langevelde et al. 2011; Somers-Yeates et al. 2013) and that were significantly more abundant in the diet of *Hemidactylus angulatus* from BDH (see below for more details). Moreover, artificial lights and the cement walls that are exposed to the sun may also possibly represent a further resource for lizards as basking sites by providing a place warmer than the surrounding environment (Werner 1990). This would be indirectly highlighted by the fact that the great majority of gecko individuals were observed in walls facing South and East exposures, with only a minority being observed in North-facing walls. In addition, the fact that substratum temperatures were significantly higher by early night hours in walls rather than on trees suggest that these concrete structures may be more favoured for thermoregulatory reasons by geckos.

We did not record any data on egg deposition by geckos in walls and other concrete structures of the BDH habitat. If there were really no eggs on the buildings, it would mean that the lizards did not reproduce there. This is not very likely as *Hemidactylus angulatus* was observed to deposit eggs in partially dilapidated cement walls elsewhere, for instance in Lomé, Togo [Luiselli, Segniagbeto et al., unpublished observations]). Anyway, in order to decide whether one habitat is better than the other one, the reproductive success of individuals from both habitats should be estimated. We did not collect such data, so the actual results do not allow concluding if the animals from both habitats live there, or use one of them only for hunting. So, our study reports data on the preference "for presence" but not properly the use of the habitat, that is not limited, by definition, to food acquisition (e.g. Krausman 1999; Garshelis 2000).

3.2. Food habits

Overall, our data on the diet taxonomical composition of *Hemidactylus angulatus* concur with Avery (1980), who studied conspecifics in Ghana showing that they fed entirely on arthropods, and with Lepidoptera larvae and cockroaches forming 40% of the total weight of food. In our case, however, also Diptera were abundantly eaten by geckos. Our data are also consistent with diet data on Gekkonidae from elsewhere, that generally feed upon a wide range of insectivorous prey, both flying and terrestrial (Saenz 1996; Zamprogno & Teixeira 1998; Cast 2000; Rugiero et al. 2007; Albuquerque et al. 2013). The presence of both sedentary (for instance Araneae) and mobile (for instance Lepidoptera adults) prey species in the gecko diets suggests that *Hemidactylus angulatus* uses a mixed foraging strategy at the study area, including components of "sit-and-wait" and "active foraging". Mixed foraging strategies were also observed in other gekkonid species (Werner et al. 1997; Bauer 2007). It has been suggested that reptile species tend to forage actively when food availability is low, despite their usual "sit-and wait" foraging strategy (Ananjeva and Tsellarius 1986; Hódar et al. 2006).

All our independent set of analyses (diet diversity metrics; contingency tables on taxonomic dietary composition and rank-abundance diagrams) clearly revealed that geckos exhibited the same feeding strategy by season and by habitat, thus eating probably the prey types that were available in the field. More specifically, since rank-abundance curves obtained for both habitats were similar, we would conclude that lizards do not select for habitat for different probability to find a given prey species. These evidences would suggest that *Hemidactylus angulatus* is a dietary insectivorous generalist, as most gecko species that have been studied so far (Megías et al. 2011; Gonçalves-Sousa et al. 2019), and as it can be predicted if we consider the ability of the study species to inhabit heavily human-made habitats. Our study also pointed out that *Hemidactylus angulatus* does not show any remarkable seasonal variation in diet taxonomic composition. This pattern does not mirror seasonal trends observed in another species of West African lizard (*Trachylepis quinquetaeniata*: Scincidae), whose dietary patterns were influenced by the wet-dry-seasonal alternance, with rainfall being more important than temperature in determining the dietary variations (Dendi et al. 2019).

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Appendix 1: Substratum temperatures recorded at several sites of gecko sighting, in both habitat types, during the field research. Both the temperature (°C) and the time of the day (Lagos standard time) are indicated in this table.

BDH	**Temperature °C**	**time pm**	**PTH**	**Temperature °C**	**time pm**
Biology building	34	07:09	*Elaeis guineensis*	33.2	07:25
Biology laboratory wall	38	07:15	*Elaeis guineensis*	33.1	07:28
Biology laboratory wall	36	07:21	*Elaeis guineensis*	33	07:30
Chemistry laboratory wall	35	07:36	*Gmelina arborea*	33.1	07:33
Chemistry laboratory wall	34	07:39	*Terminalia mantaly*	33.1	08:35
Chemistry laboratory wall	33.2	07:42	*Terminalia mantaly*	33.2	08:38
Environmental sciences wall	33	07:55	*Persea americana*	32	08:41
Environmental sciences wall	33	07:59	*Terminalia ivorensis*	31	08:44
Environmental sciences wall	34	08:02	*Tectona grandis*	32	09:04
incandescent bulb	39	07:12	*Jacaranda mimosifolia*	31.3	09:08
Management science building wall	34.1	08:12	*Eucalyptus sp.*	32	09:12
Management science building wall	35	08:16	*Terminalia catappa*	32	09:15
Management science building wall	34	08:19	*Pinus caribaea*	32	07:15
PG Auditorium wall	33.1	08:08	*Pinus caribaea*	32.1	07:19
Physics laboratory wall	35	07:45	*Pinus ponderosa*	34.1	07:12
Physics laboratory wall	35	07:48	*Pinus ponderosa*	32	07:17
Physics laboratory wall	33	07:52	*Pinus ponderosa*	33.2	07:21
Tetfund building wall	33.2	08:23	*Psidium guajava*	32.3	06:53
Tetfund building wall	34.1	08:27	*Psidium guajava*	33	06:56
Tetfund building wall	33.8	08:32	*Mangifera indica*	33	07:03