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Diet of the Kotschy's Gecko Mediodactylus kotschyi rumelicus (Müller, 1940) (Reptilia: Gekkonidae) from the City of Plovdiv (Bulgaria)

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Abstract. The seasonal and habitat variation of the trophic spectrum of Kotschy's gecko (*Mediodactylus kotschyi rumelicus*), as well as the species' trophic niche breadth was studied, based on feces analysis. The material was collected in spring and autumn of 2007 and 2008. The diet of *M. kotschyi* consists mainly of insects (59.51%), and from the non-insect food we registered Aranea (3.46%) and Acari (4.50%). From the insects, largest share have the ants - Hymenoptera, Formicidae (41.18%), followed by Coleoptera (11.77%), represented mainly by the Curculionidae family and Heteroptera (3.46%). In most of the samples (93.41%) were identified a significant amount of plant residues (32.52% of the total food). The taxonomic contents of the gecko's diet remains almost unchanged in the spring and in the autumn. The index of dominance of Berger-Parker (d) showed a moderate value of 0.41 and the trophic niche breadth, calculated with Simpson's diversity index (1/ Simpson) was 3.53, which is relatively low value.

Key words: feeding ecology, Kotschy's gecko, diet, trophic niche, Plovdiv.

Introduction

Studying the feeding ecology of a species provides important information for the used food resources, the most common and the proportion of each food component, as well as the role of the species in the interspecific and intraspecific relationships (BONFIGLIO *et al.*, 2006). A broad food niche is common for species with high ecological plasticity, which in combination with appropriate environmental conditions, provides a sound basis for the successful occupation of new territories (RÖDDER *et al.*, 2008). From this perspective, the study of the ecological role of the species in the natural and for survival and existence in anthropogenically transformed landscapes is a necessary part of the overall ecological characteristics of the species (SEMENOV & SHENBROT, 1988).

Widely popular opinion among herpetologists is that lizards are opportunistic predators and the major variations in their food spectrum are due to the size of their body and differences in the availability of food (AVERY, 1966; ARNOLD, 1987). True specialists, regarding food among lizards are rare, and most species use a variety of different organisms as food (GREENE, 1982). Moreover, the trophic

spectrum of lizards may vary in different habitats and in different seasons (JAMES, 1991).

Most of the lizards, occurring in Bulgaria, feed exclusively on invertebrates. With the exception of some representatives of the Lacertidae family (PETERS, 1963; ANGELOV *et al.*, 1966; 1972a; b; c; KABISCH & ENGELMANN, 1969; 1970; TOMOV, 1990; MITOV, 1995; DONEV, 1984a; b; DONEV *et al.*, 2005; MOLLOV *et al.*, 2012; MOLLOV & PETROVA, 2013), the diet of the rest of the lizard species in Bulgaria remains unstudied (MOLLOV *et al.*, 2012). From the other lizard families occurring in Bulgaria, regarding the trophic spectrum, the only studied species is the slow worm (*Anguis fragilis*) by ANGELOV *et al.* (1966) and MOLLOV (2010).

The Kotschy's gecko (*Mediodactylus kotschyi*) is the only representative of the Gekkonidae family in Bulgaria (BESHKOV & NANEV, 2002; BISERKOV *et al.*, 2007), which is represented with three subspecies in the country (*M. k. bibroni* (Beutler and Gruber, 1977) - distributed in the southern part of Struma Valley (Petrich Town, Sandanski Valley and north to Kresna Gorge), also occurring in the cities of Gotse Delchev and Blagoevgrad; *M. k. danilewskii* (Strauch, 1887) - occurs in the Eastern Rhodopes Mts., the Maritsa River Valley and Tundzha River Valley, north to Nova Zagora City and Yambol City and along the Black Sea coast north of Balchik Town, isolated habitats are located in Rousse City and the Orlova Chuka Cave and *M. k. rumelicus* (Müller, 1940) - recorded in the western parts of the Upper Thracian Plain (the cities of Pazardzhik, Plovdiv and Asenovgrad and Kuklen Village). This is a primarily synanthropic species and in Bulgaria there are only few known populations from natural habitats (BESHKOV & NANEV, 2002). So far there is only partial and incomplete data in the literature on the composition of the diet and feeding ecology of this species and there are no comprehensive studies on this subject, conducted in Bulgaria. The aim of this study was to research the qualitative and quantitative composition of the trophic spectrum, trophic niche breadth and trophic specialization of the Kotschy's gecko (*Mediodactylus kotschyi rumelicus*) in Plovdiv City (Bulgaria).

Material and Methods

For the purposes of the current study we collected a total of 91 samples of Kotschy's Gecko (*Mediodactylus kotschyi rumelicus*) feces from three protected areas (three of the Plovdiv Hills - Nature Monument "Mladeshki halm" Hill, NM "Halm na osvoboditelite" Hill and NM "Danov halm" Hill) and part of one protected zone (NATURA2000 site "Maritsa River" - BG0002087) in Plovdiv City (Fig. 1). The material was collected in the spring and the autumn of 2007 and 2008 and is deposited in the herpetological collection of the Department "Ecology and Environmental Conservation" at the University of Plovdiv.

The samples were collected from typical habitats inhabited by geckos, namely supporting walls along the alleys of the hills of Plovdiv and the supporting wall of Maritsa River in the central part of the city (see MOLLOV & VELCHEVA, 2010). We chose precisely these areas, since they are few of the only available places, where we have access to the geckos and their habitats, from where the feces were collected, unlike the rest of the city, which is densely built with residential buildings and houses, where there is no free access.

Analysis of feces can provide some information about the composition of the diet of the geckos, although faeces do not provide a complete assessment of the dietary spectrum of a given species, because the soft body parts of the prey tend to be less well preserved in remains (see HÒDAR & PLEGUEZUELOS, 1999; LUISELLI & AMORI, 2016). Geckos seek refuge during the day in crevices of the supporting walls, and at night they move around on the ground a few meters from the walls (MOLLOV, 2005). During each visit we collected all feces found at the sites. In the studied areas there

are no other gecko species and the feces of other lizards are clearly distinguishable from the geckos' (HÒDAR & PLEGUEZUELOS, 1999). Since sampling took place in the same areas around the supporting walls and we collected all visible feces on each visit, we assume that there is equal probability that feces from every living gecko in the particular micro-habitat had been sampled. of course this method does not allow for the identification of the individual who has deposited the single scat (LUISELLI & AMORI, 2016). The feces were collected dry in plastic bags with zip and labeled. Later in the laboratory the samples were soaked in water and examined under a microscope. The food remains were separated and sorted and identified to the lowest taxonomic level possible, depending on the level of decomposition, using available guides (IVANOV *et al.*, 1981). The taxonomy follows Fauna Europaea (DE JONG *et al.*, 2014).

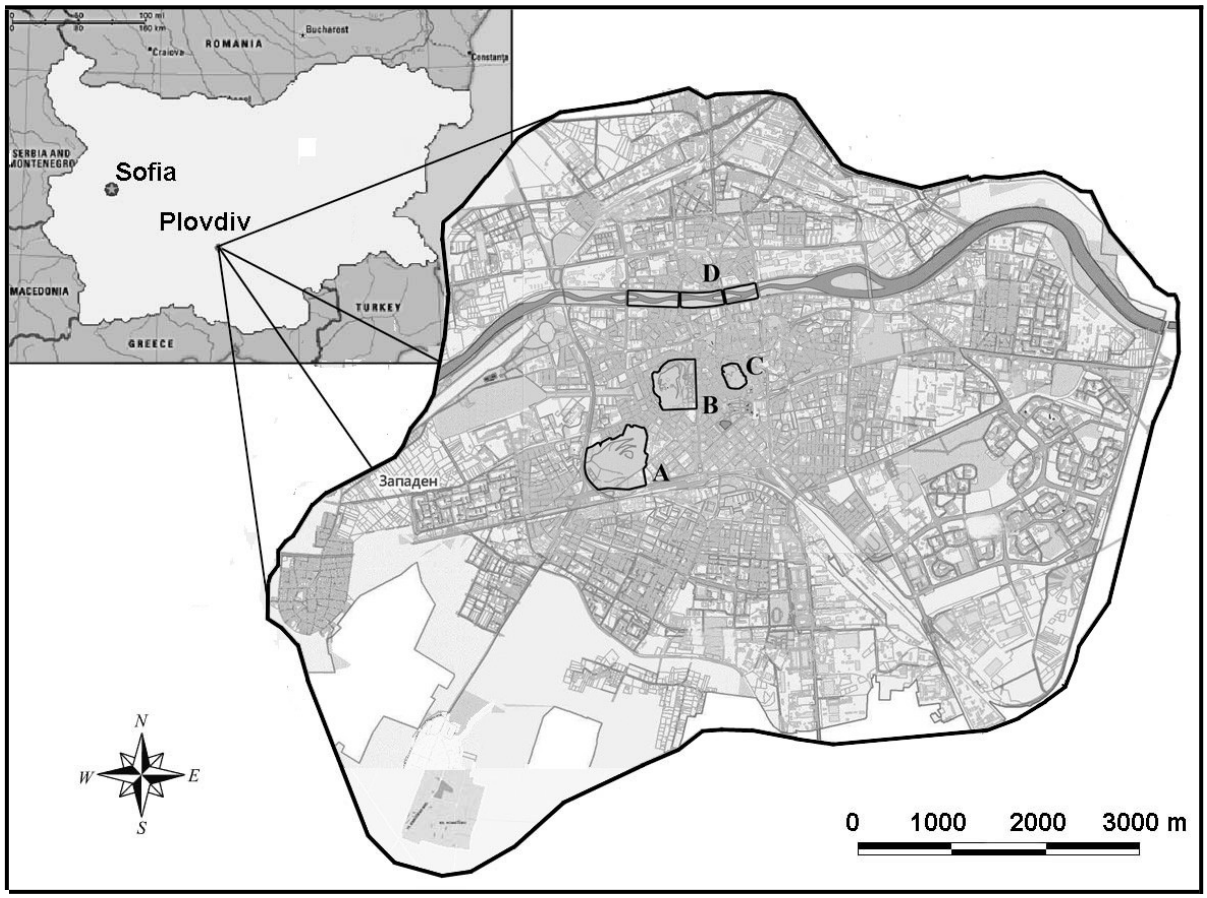

Fig. 1. Indicative map of the city of Plovdiv and the studied sites. Legend: A - NM "Mladezhki halm" Hill, B - NM "Halm na osvoboditelite" Hill, C - NM "Danov halm" Hill, D - part of Maritsa River.

For each recorded taxa in the trophic spectrum are given the number of prey categories, the number of prey items and percentage proportion, the number of samples that contained the taxon and frequency of occurrence (the ratio between the number of samples that contain a certain taxon prey and the total of analyzed samples, the obtained value being expressed in percentages).

Sampling adequacy was determined using Lehner`s formula (LEHNER, 1996):

$$Q = 1 - \frac{N_1}{I},$$

rising from 0 to 1, where N_1 is the number of the food components occurring only once, and I is the total number of the food components.

The diversity of the diet (niche breadth) was calculated, using the reciprocal value of the Simpson's diversity index (MAGURRAN, 1988):

$$S = \frac{1}{\sum p_i^2},$$

where: S - trophic niche breadth; P_i - proportion of food component i.

To determine the level of trophic specialization of we used the index of dominance of Berger-Parker (d), calculated by the following formula (MAGURRAN, 1988):

$$d = \frac{n_i \max}{N},$$

where: N - the number of all recorded food components (taxa); $n_i$max - the number of the specimens form taxon i (the most numerous taxon in the diet). The Berger-Parker index (d) varies between 1/N and 1. A value closer to 1 means a higher specialization in the choice of food; a value closer to 1/N is typical for a species that is a general feeder (polyphage).

The results were statistically processed using descriptive statistics and cluster analysis (Paired Group Linkage, Hamming Similarity Measure), for determining the similarity of the trophic spectrum of the geckos from the different localities (FOWLER *et al.*, 1998). For the descriptive statistical processing of the data and the cluster analysis, as well as the calculations of Simpson's diversity index and the Berger-Parker index we used the computer software "PAST" (HAMMER *et al.*, 2001).

Results

For the whole period of study we recorded totally 289 prey items in the trophic spectrum of the Kotschy's Gecko in the studied sites in the city of Plovdiv, which were determined in 17 taxa (food categories) (Table 1).

The qualitative and quantitative composition of the trophic spectrum of the Kotschy's Gecko (*Mediodactylus kotschyi rumelicus*) in the city of Plovdiv, for the entire period of study is presented in Table 2. The adequacy of the samples, calculated by the Lehner's formula is 0.76 for all samples and even higher by localities (see Table 4). This value is considered sufficient for this kind of research. The data from the table shows that the food of *M. kotschyi* consists mainly of insects (59.51%), and from the non-insect food we registered Aranea (3.46%) and Acari (4.50%). From the insects, largest share have the ants - Hymenoptera, Formicidae (41.18%), followed by Coleoptera (11.77%), represented mainly by the Curculionidae family and Heteroptera (3.46%), to which belongs to only determined to species level taxon - *Neides tipularius*.

In most of the samples (93.41%) were identified a significant amount of plant residues (32.52% of the total food). The plant remains consisted of seeds in sizes from 0.8 to 4.8 mm; leaves and parts of leaves with a length of 5 to 20 mm, and a stem 7 mm long as well as other plant remains.

The index of dominance of Berger-Parker (d) showed e moderate value of 0.41 and the trophic niche breadth, calculated with Simpson's diversity index (1/Simpson) was 3.53, which is relatively low value.

The analysis of the seasonal distribution of the food showed that, the taxonomic contents of the gecko's diet remains almost unchanged in the spring and in the autumn (Table 3). In both season predominant are the ants (38.54% - in the spring and 42.49% - in the autumn), followed by Coleoptera (7.29% - in the spring and 14.00% - in the autumn), while in the spring samples we recorded only undetermined to family level coleopterans and representatives of the Curculionidae family, and the other families

from the Coleoptera order, were registered only in the autumn samples. From the non-insect invertebrates in the spring predominant are Acari (mainly Oribatida) - 6.25% (3.63% in the autumn) and Aranea (5.21% - in spring and 2.59% - in authumn). The third predominating prey taxa in the autumn was Heteroptera with 4.15% from the trophic spectrum, while their quantity in the spring samples was significantly lower (2.08%). Plant residues are present in significant quantities as in spring (37.50% in all samples), as well as in autmn (30.05% in about 88% of the samples).

Table 4 shows the trophic spectrum of the 4 different populations of the Kotschy's gecko in Plovdiv. The most diverse is the diet of the geckos from "Mladezhki halm" Hill. Aside the plant remains, the predominant taxon is Hymenoptera, Formicidae (35.43%), followed by Coleoptera (13.14%) and Acari (5.14%). In the samples from "Halm na osvoboditelite" Hill most numerous are again Formicidae (68.18%), aside from plant residues that occupy second place, followed again by Coleoptera (10.61%) and Aranea (3.03%). In the samples from "Danov Halm" Hill the most numerous are the plant remains. From the animal prey taxa most numerous are again Hymenoptera, Formicidae (27.78%), followed by Acari (16.67%) and Aranea (11.11%). In the samples from the Maritsa River again the most numerous are the plant remains and in the food of animal origin predominate Formicidae (23.33%), followed by Coleoptera (13.33%) and Aranea and Trichoptera (Hydropsychidae) with 6.67%. We recorded representatives from the Hydropsychidae family, which are aquatic organisms inhabiting the shores of the various aquatic basins, only in the samples from Maritsa river.

To determine the similarity between the samples from the four localities, we used cluster analysis, based on quantitative data (Fig. 2). From the dendrogram it is visible that with similarity of around 4% the samples from "Mladezhki halm" Hill separate in independent cluster. From the remaining samples, with 60% similarity Maritsa River is separated in second cluster. And the samples from "Halm na osvoboditelite" Hill and "Danov halm" Hill are grouped in a third cluster with about 65% similarity.

Discussion

The diet on the Kotschy's gecko (*M. kotschyi rumelicus*) consists mainly of arthropods, as pointed out by the partial data of other authors for this species in Bulgaria (KOVACHEV, 1912; MILENKOV, 1962; ZHIVKOV & DOBREV, 2001; BESHKOV & NANEV, 2002; PROFIROV, 2003). The main food source for the Kotschy's Gecko in Plovdiv are the ants, which occupy the highest percentage and frequency in both studied seasons and in all populations. The representatives of the order Coleoptera also play an important role in the species' diet. From the non-insect invertebrates the most important prey items are Araneae and Acari. The beetles and ants are basic food most probably due to the abundance of this preys and the wide range of habitats where they can be found (MOLLOV, 2008). Despite the predominance of these two taxa it appears that the Kotschy's gecko shows no specialization in its food and consumes animals with low and high nutritional value.

Table 1. Descriptive statistics of the samples by seasons and localities.

	Number of food categories	Number of prey items	Mean	Standard deviation (SD)
Spring	17	96	5.65	11.76
Autumn		193	11.35	22.83
NM "Mladezhki Halm"		175	10.29	19.89
NM "Halm na osvoboditelite"		66	3.88	10.99
NM "Danov Halm"		18	1.06	1.89
Maritsa River		30	1.76	3.68
Total		289	17.00	34.41

Table 2. Composition of the trophic spectrum of the Kotschy's Gecko (*Mediodactylus kotschyi rumelicus*) in the city of Plovdiv, for the entire period of study. *Legend:* **n** - number of prey items from the selected taxon, **n%** - percentage proportion from the total number of prey items, **s** - number of samples, the selected taxon was recorded in; **s%** - frequency of occurrence (percentage proportion of the samples, containing the selected taxon).

Prey items	**n**	**n%**	**s**	**s%**
Araneae	10	3.46	9	9.89
Acari-undet.	2	0.69	2	2.20
Acari, Oribatida	11	3.81	11	12.09
Insecta-undet.	3	1.04	3	3.30
Hymenoptera-undet.	1	0.35	1	1.10
Hymenoptera, Formicidae	119	41.18	68	74.73
Coleoptera-undet.	22	7.61	19	20.88
Coleoptera, Buprestidae	1	0.35	1	1.10
Coleoptera, Curculionidae	8	2.77	8	8.79
Coleoptera, Scarabeidae	1	0.35	1	1.10
Coleoptera, Elateridae	2	0.69	2	2.20
Homoptera, Cicadomorpha	2	0.69	2	2.20
Heteroptera	8	2.77	8	8.79
Heteroptera (*Neides tipularius*)	2	0.69	2	2.20
Trichoptera (Hydropsychidae)	2	0.69	2	2.20
Lepidoptera (larvae)	1	0.35	1	1.10
plant remains	94	32.53	85	93.41
Total	**289**	**100.00**	**91**	**-**
Lehner's index		**0.765**		
Berger-Parker		**0.412**		
1/Simpson		**3.531**		

Table 3. Seasonal composition of the trophic spectrum of the Kotschy's Gecko (*Mediodactylus kotschyi rumelicus*) in the city of Plovdiv. *Legend:* **n** - number of prey items from the selected taxon, **n%** - percentage proportion from the total number of prey items, **s** - number of samples, the selected taxon was recorded in; **s%** - frequency of occurrence (percentage proportion of the samples, containing the selected taxon).

Prey items	**Spring**				**Autumn**			
	n	**n%**	**s**	**s%**	**n**	**n%**	**s**	**s%**
Araneae	5	5.21	5	15.63	5	2.59	4	6.78
Acari-undet.	1	1.04	1	3.13	1	0.52	1	1.69
Acari, Oribatida	5	5.21	5	15.63	6	3.11	6	10.17
Insecta-undet.	1	1.04	1	3.13	2	1.04	2	3.39
Hymenoptera-undet.	0	0.00	0	0.00	1	0.52	1	1.69
Hymenoptera, Formicidae	37	38.54	25	78.13	82	42.49	43	72.88
Coleoptera-undet.	5	5.21	4	12.50	17	8.81	15	25.42
Coleoptera, Buprestidae	0	0.00	0	0.00	1	0.52	1	1.69
Coleoptera, Curculionidae	2	2.08	2	6.25	6	3.11	6	10.17
Coleoptera, Scarabeidae	0	0.00	0	0.00	1	0.52	1	1.69
Coleoptera, Elateridae	0	0.00	0	0.00	2	1.04	2	3.39
Homoptera, Cicadomorpha	0	0.00	0	0.00	2	1.04	2	3.39
Heteroptera	2	2.08	2	6.25	6	3.11	6	10.17
Heteroptera (*Neides tipularius*)	0	0.00	0	0.00	2	1.04	2	3.39
Trichoptera (Hydropsychidae)	2	2.08	2	6.25	0	0.00	0	0.00
Lepidoptera (larvae)	0	0.00	0	0.00	1	0.52	1	1.69
plant remains	36	37.50	32	100.00	58	30.05	52	88.14
Total	**96**	**100.00**	**32**	**-**	**193**	**100.00**	**59**	**-**

Table 4. Composition of the trophic spectrum of the Kotschy's Gecko (*Mediodactylus kotschyi rumelicus*) in the city of Plovdiv, by localities. *Legend:* **n** - number of prey items from the selected taxon, **n%** - percentage proportion from the total number of prey items, **s** - number of samples, the selected taxon was recorded in; **s%** - frequency of occurrence (percentage proportion of the samples, containing the selected taxon).

Prey items	"Mladezhki halm" Hill				"Halm na osvoboditelite" Hill				"Danov halm" Hill				Maritsa River			
	n	**n%**	**s**	**s%**	**n**	**n%**	**s**	**s%**	**n**	**n%**	**s**	**s%**	**n**	**n%**	**s**	**s%**
Araneae	4	2.29	3	5.08	2	3.03	2	12.50	2	11.11	2	33.33	2	6.67	2	20.00
Acari-undet.	2	1.14	2	3.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Acari, Oribatida	7	4.00	7	11.86	0	0.00	0	0.00	3	16.67	3	50.00	1	3.33	1	10.00
Insecta-undet.	2	1.14	2	3.39	0	0.00	0	0.00	1	5.56	1	16.67	0	0.00	0	0.00
Hymenoptera-undet.	1	0.57	1	1.69	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Hymenoptera, Formicidae	62	35.43	41	69.49	45	68.18	16	100.00	5	27.78	4	66.67	7	23.33	7	70.00
Coleoptera-undet.	12	6.86	10	16.95	6	9.09	6	37.50	0	0.00	0	0.00	4	13.33	3	30.00
Coleoptera, Buprestidae	1	0.57	1	1.69	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Coleoptera, Curculionidae	7	4.00	7	11.86	1	1.52	1	6.25	0	0.00	0	0.00	0	0.00	0	0.00
Coleoptera, Scarabeidae	1	0.57	1	1.69	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Coleoptera, Elateridae	2	1.14	2	3.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Homoptera, Cicadomorpha	2	1.14	2	3.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Heteroptera	6	3.43	6	10.17	1	1.52	1	6.25	1	5.56	1	16.67	0	0.00	0	0.00
Heteroptera (*Neides tipularius*)	2	1.14	2	3.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Trichoptera (Hydropsychidae)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	6.67	2	20.00
Lepidoptera (larvae)	1	0.57	1	1.69	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
plant remains	63	36.00	59	100.00	11	16.67	11	68.75	6	33.33	6	100.00	14	46.67	9	90.00
Total	**175**	**100.00**	**59**	**-**	**66**	**100.00**	**16**	**-**	**18**	**100.00**	**6**	**-**	**30**	**100.00**	**10**	**-**
Lehner's index		**0.76**				**0.88**				**0.88**				**0.94**		

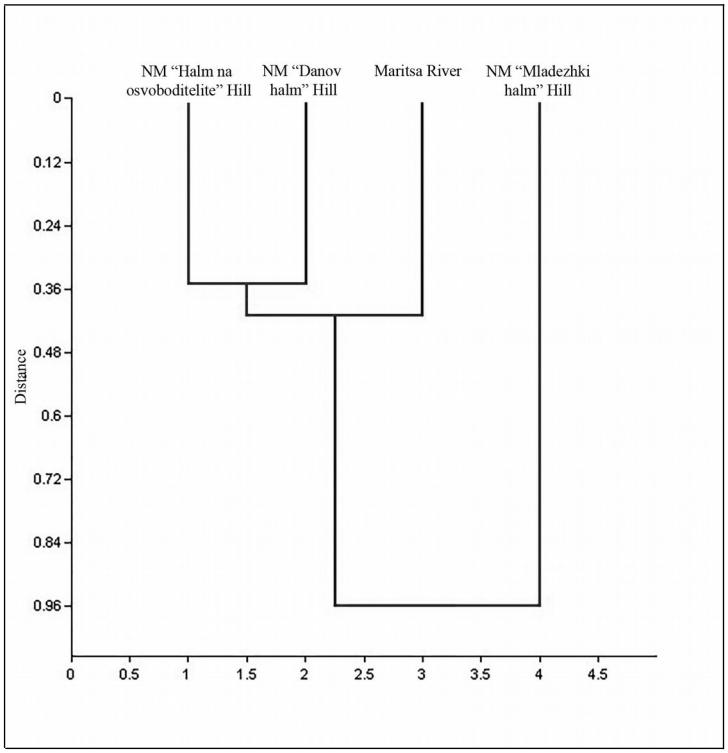

Fig. 2. Cluster analysis, based on quantitative data (Paired Group Linkage, Hamming Similarity Measure) of the trophic spectrum of the Kotschy's gecko from the four studied localities in the city of Plovdiv.

M. kotschyi can be classified as zoophagous polyphage with opportunistic feeding behavior. Depending on the season and the characteristics of the habitat the food can vary and certain taxa may prevail.

The high percentage of registered plant residues in food of the Kotschy's gecko in Plovdiv suggests that they are not accidentally ingested while catching animals, and it is possible that under certain conditions the geckos may actively include plant food in their trophic spectrum.

Predators are extremely sensitive to the complexity and structure of the ecosystems and lizards, because of their small size and opportunistic feeding behavior, usually overcome shortage of food resources, in some cases by adding plants in their diet (VAN DAMME, 1999; SCHWENK, 2000; COOPER & VITT, 2002). Many lizard species often include plant material in their trophic spectrum, however, most studies investigating these omnivorous species concluded that despite the size of the lizards in most cases they have low trophic specialization (COOPER & VITT, 2002). That is why most omnivorous lizards are considered opportunistic herbivorous species with a common morphology, as they do not show any specific morphological "adaptation" characteristic of actual herbivorous species (SCHWENK, 2000).

The trophic spectrum of *M. kotschyi* in Plovdiv does not differ significantly between the different localities in the city, but with the greatest prey variety is characterized the diet of the geckos from "Mladezhki halm" Hill. The reason for this is probably the fact that this is the largest protected area in the studied area and contains the greatest diversity of habitats which is a prerequisite for a rich food base. The food range of the populations of the other two hills ("Halm na osvoboditelite" Hill and "Danov halm" Hill) show high similarity, which can be explained by the fact that both areas are located close together in the city center and offer similar habitats and environmental conditions. The diet of the population from Maritsa River shows some differences and includes moisture-loving species that are only found near ponds and absent from the hills. We think the only reason the Kotschy's gecko can be found along the banks of Maritsa River in Plovdiv is the presence of a retaining wall along the banks of the river, where geckos find excellent hiding spots and living conditions (similar to those on the retaining walls on the alleys of the hills).

This is the first detailed study on the diet of the Kotschy's gecko in Bulgaria and in the Bulgarian herpetological literature so far there are only partial data for the qualitative composition of the food spectrum without quantification.

The first data about the food of *M. kotschyi* can be found in the work of KOVACHEV (1912) where he reports that the species gets out at night to "hunt for insects and stalking prey on the walls of houses under street lamps around the city." According to MILENKOV (1962) *M. kotschyi* begins to catch their food at night, which consists of "flies, mosquitoes, spiders, beetles and other arthropods." ZHIVKOV & DOBREV (2001) report that the diet of the Kotschy's gecko is composed of "insects, spiders, centipedes and other night-active arthropods". BESHKOV & NANEV (2002) supplement that geckos are feeding mainly on "insects, spiders and other". According to Profirov (2003) of the food geckos are "different insects, spiders, millipedes, and other", while according BISERKOV *et al.* (2007) geckos eat "night-active invertebrates".

According to SHTERBAK (1960) based on the stomach contents of geckos from Criema, the food of *M. kotschyi daniliewskii* consists essentially of Diptera (22.48%), followed by Hymenoptera (19.38%), Aranea (19.05%), Lepidoptera (12.79%) and Coleoptera (12.7%). In another study by the same author (SHTERBAK, 1966) from Crimea on the same subspecies, the largest share in the diet belonged again to Diptera (20.08%), followed by Lepidoptera (18.5%) and Aranea (14.17%). According to VALAKOS & VLACHOPANOS (1987, 1989), the main prey

taxa in the composition of the diet of *M. kotschyi* from Greece are Coleoptera-larvae (63.9%), Aranea (9.17%) and Coleoptera (8.28%). Our data confirm only partially the data from the above mentioned authors. The main reason for this in our opinion, is the different method used in the studies - the diet of the geckos in Crimea and Greece was examined by studying the stomach contents, while our study is based on feces analysis, which is far more inaccurate, but invasive method. Not all taxa can leave a distinct residues in feces and probably this could explain the absence of taxa as Lepidoptera and Diptera, as well as the relatively low percentage of spiders in the trophic spectrum of *M. kotschyi* from Plovdiv.

Regarding the trophic niche breadth, our data is close to the results obtained by VALAKOS & VLACHOPANOS (1987) from Greece, where the niche breadth of *M. kotschyi,* calculated by us form their data is 2.32. We also calculated the niche breadth from the data by SHTERBAK (1960, 1966) from Crimea, which showed relatively high value - 10.88 and 11.19 respectively.

Our data showed no significant difference in the trophic spectrum of the Kotschy's gecko in Plovdiv in both sampling seasons. In autumn we recorded a greater amount of food intake, which can be partly explained by the accumulation of nutrients by the geckos before hibernation. According to VALAKOS & VLACHOPANOS (1987) for the geckos from Greece in March the food contains mainly larvae of Hemiptera (68.42%), Coleoptera-imago and larvae (respectively 13.6%); in July the larvae of Coleoptera (76.6%), Aranea (8.03%) and Coleoptera-imago (7.3%) prevail, and in November - Aranea (30.77%), Hymenoptera, Formicide and Coleoptera (respectively 11.54%). According to the same authors of another study in Greece in 1989 (VALAKOS & VLACHOPANOS, 1989) in July in the diet was consisted by larvae of Coleoptera (70%), Coleoptera-imago and Aranea (approximately 7%) and in November - Aranea (about 36%), Diptera (about 20%) and Acari (about 12%). This data once again confirms the opportunistic behavior of feeding the geckos as during different seasons they feed on organisms that are the most numerous and present in the habitat.

Another study by VALAKOS & POLYMENI (1990) shows that the insect larvae takes even bigger portion of the gecko's diet – 72%, as the second most important taxa were Tysanura and Coleoptera (12.5%) and Aranea (9.9%). The low percentage of insect larvae in our samples can be explained with used method by analyzing scat samples.

The analysis of the trophic spectrum of other closely related to *M. kotschyi* species, shows that, similar to the Kotschy's gecko, other gecko species from the genus *Mediodactylus* also exhibit opportunistic feeding behavior. According to BOGDANOV (1960) *M. russowii* of Russia, feeds mainly Hymenoptera (56.15%), of which the ants predominate (28.57%), Coleoptera (49.21%) and Heteroptera (23.82%), whose diet resembles the one of *M. kotschyi* from the city of Plovdiv. According to the same author *Tenuidactylus caspius* feeds mainly on Coleoptera (48.15%), Diptera (14.81%) and Isopoda (5.56%), while *T. fedtschenkoi* feeds on Hymenoptera (37.93%), from which ants occupy 31.03%, followed by Coleoptera (24.14%) and Hemiptera and Diptera (by 10.34%).

The two main predating strategies in lizards are "sit-and-wait" and "active search". The first strategy requires the predator to be standing still in one place and attack prey that runs around, while the second strategy requires the predator to move actively attacking any animal, with suitable size that it meets (HUEY & PIANKA, 1981; COOPER JR., 1995; PERRY & PIANKA, 1997). Although the active search for food requires more effort and burns more calories species using this feeding strategy capture more animals from the "sit-and-wait" species (PIANKA, 1986). This approach may be effective for nocturnally active animals, especially ectotherms, because as temperatures get lower at night this can significantly reduce

the time to hunt and therefore the animal will need the most effective method of hunting. The benefits the "sit-and-wait" strategy is that the predator saves energy and the risk of being caught by other predators is reduced to a minimum (PIANKA, 1986). In our opinion, the Kotschy's gecko uses both strategies to catch its prey, depending on environmental conditions, season and habitat. According to SHTERBAK (1960) at low temperatures geckos can even completely stop foraging. This behavior can be explained by the fact that *M. kotschyi* is thermophilic species (MOLLOV & VELCHEVA, 2015). The species hunts mostly at night, as in the early hours of the evening before they air temperature gets colder, "active search" is used and at that time geckos can often be seen on the walls around the illuminated areas under outdoor lights that attract insects (ZHIVKOV & DOBREV, 2001), while later when the air temperature gets colder or under less favorable conditions geckos use the "sit-and-wait" technique.

Conclusions

The Kotschy's gecko (*M. kotschyi rumelicus*) in Plovdiv City feeds mainly on arthropods, of which the largest share have the representatives of the Formicidae family, orders Coleoptera and Hemiptera. In urban environment *M. kotschyi* can use plants as food - a mechanism to overcome shortage of food resources under certain conditions or habitats. The qualitative composition of the food remained almost unchanged in spring and in autumn, as in both seasons are predominating Formicidae and Coleoptera. Most diverse is the diet of the geckos Mladezhki Halm Hill. As from the other studied areas, more specific is the diet of the population from Maritsa River, while the populations from "Halm na osvoboditelite" Hill and "Danov halm" Hill show high similarity in the trophic spectrum. *M. kotschyi* can be classified as zoophague with opportunistic feeding behavior. Depending on the season and habitat characteristics the trophic spectrum and trophic niche breadth of the species can vary and certain taxa may predominate.

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