ACTA ZOOLOGICA BULGARICA
Acta zool. bulg., Suppl. 4, 2012: 133-140

Trophic Niche Breadth and Niche Overlap Between Two Lacertid Lizards (Reptilia: Lacertidae) from South Bulgaria

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Abstract: The seasonal variation of the trophic spectrum of two sympatric lizards (*Lacerta viridis* and *Podarcis tauricus*) is presented as well as the species' trophic niche breadth and niche overlap. The material for the current study was collected in 1980-1981 in surroundings of Purvomay Town in South Bulgaria. The main food sources for both lizards are insects. For *P. tauricus* the predominating food type is Orthoptera (44.62%), followed by Coleoptera (14.36%) and Hemiptera (7.18%) and from the diet of *L. viridis* predominating are again Orthoptera (34.05%), followed by Coleoptera (12.97%) and Hymenoptera (9.73%). The possible ecological aspects of interspecific competition are discussed.

Key words: *Podarcis tauricus, Lacerta viridis,* diet, trophic spectrum, seasonal variation, Bulgaria

Introduction

The lizard family Lacertidae (Reptilia, Squamata, Sauria) is presented with 9 species in Bulgaria (Beshkov, Nanev 2002). So far six species are studied regarding their trophic spectrum – *Lacerta viridis* (Laurenti, 1768)*, Lacerta trilineata* Bedriaga, 1886*, Lacerta agilis* Linnaeus, 1758*, Podarcis muralis* (Laurenti, 1768)*, Podarcis tauricus* (Pallas, 1814) and *Zootoca vivipara* (Jacquin, 1787) (Peters 1963, Angelov *et al.* 1966, Kabisch, Engelmann 1969, 1970, Angelov *et al.* 1972a, 1972b, 1972c, Donev 1984a, 1984b, Tomov 1990, Mitov 1995, Donev *et al.* 2005).

Balkan wall lizard (*Podarcis tauricus*) and Green lizard (*Lacerta viridis*) are two of the most common lizard species in the country (Beshkov, Nanev 2002). Their diet is relatively well studied, but there are still some aspects of their feeding ecology and behaviour, which is important aspect of the ecological studies, that remain fairly unknown. Currently there are no studies conducted in Bulgaria, concerning the species' trophic niche breadth and niche overlap, which can give valuable information about the possible interspecific competition relations between these two species at the places with sympatric distribution.

The aim of the current study is to supplement the data about the trophic spectrum of *Lacerta viridis* and *Podarcis tauricus*, by presenting new data about their diet, trophic niche breadth and niche overlap.

Material and Methods

During the current study we analysed the stomach contents of 120 specimens, belonging to Balkan wall lizard (*P. tauricus*) and 110 specimens, belonging to Green lizard *(L. viridis*). The material was collected in the period May-September 1980-1981 from the surroundings of Purvomay Town – Bryagovo Village (UTM LG44), Dragoynovo Village (UTM LG55) and Ezerovo Village (UTM LG55) and it was kept in the zoological collection of Department of Zoology, Faculty of Biology at the Paisii Hilendarski

University of Plovdiv. The stomach contents were preserved in 70% alcohol and were analysed in laboratory under a stereo microscope. The prey taxa were identified to the lowest possible taxon, based on its degree of composition, using the field guides of Ivanov *et al.* (1981) and Angelov (1994). The systematic of the identified invertebrate taxa follows 'Fauna Europaea' (Fauna Europaea Web Service 2012).

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 food components occurring only once, and I is the total number of food components.

The diversity of the diet (niche breadth) was calculated for each species, using the reciprocal value of the Simpson's diversity index (Pianka 1973, Begon *et al.* 1986):

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

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

To determine the level of food specialization of each species 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 – number of all recorded food components (taxa); $n_i$max – number of specimens form taxon i (the most numerous taxon in the diet). 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 food niche overlap was calculated by Pianka's adaptation of Mac Arthur and Levin's formula (Pianka 1973):

$$O_{j,k} = \frac{\sum P_{ij} . P_{ik}}{\sqrt{\sum P_{ij}^2 . \sum P_{ik}^2}},$$

where: j and k refer to the two species under comparison; O – niche overlap; P_i – proportion of food component i.

The results were statistically processed using descriptive statistics and t-test for independent samples, to compare the numeric proportion all prey taxa between species in order to detect differences in the use of food resources. Because the data did not have normal distribution it was normalized using the arcsine transformation (Fowler *et al.* 1998). Cluster analysis (Bray-Curtis index, group average link) was used to determine the similarity between the trophic spectrums of both species during the different months (seasons).

For the statistical processing of the data we used the software package Statistica 7.0 (StatSoft Inc. 2004). For the calculations of Simpson's diversity index and the Berger-Parker index and the cluster analysis we used the computer software BioDiversityPro (McAleece *et al.* 1997) and for the calculation of the niche overlap we used the computer program EcoSim 7.0 (Gotelli, Entsminger 2001).

Results and Discussion

The analysed stomach contents of *P. tauricus* and *L. viridis* contained 195 and 184 prey items, respectively, and were divided into 19 prey categories. The identified prey remains are referred to as 'prey items' and they were identified to order or family level, dividing them into 'prey categories' listed below. The descriptive statistics of the diet of both species (number of stomachs, number of prey items and number of prey categories, means, standard deviation and standard error) are given in Table 1. Box and Whiskers plots of the trophic spectrum of both species are presented in Fig. 1. The average number of prey items per stomach for the studied lizard species is very similar: *P. tauricus* – 1.63; *L. viridis* – 1.68. The qualitative and quantitive proportion of

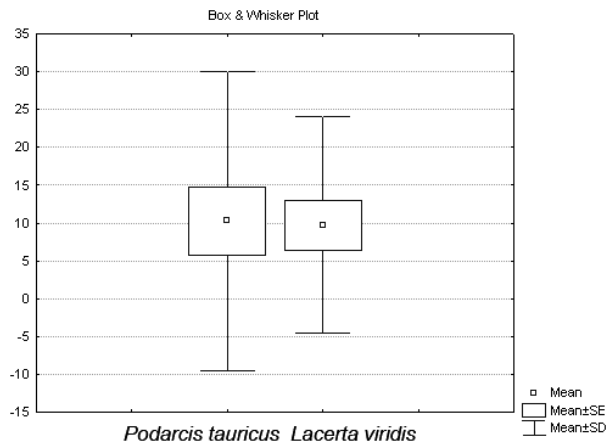

Fig. 1. Box & Whiskers plots of the diet of *Podarcis tauricus* and *Lacerta viridis* for the whole period of study.

trophic spectrum, as well as trophic niche breadth and niche overlap of studied lizard species is presented in Table 2. The insects are the predominating prey in both species, as for the non-insect preys predominating are the spiders.

The main food source for both lizards is insects. For *P. tauricus* the predominating food type is Orthoptera (44.62%), followed by Coleoptera (14.36%) and Hemiptera (7.18%) and from the diet of *L. viridis* predominating are again Orthoptera (34.05%), followed by Coleoptera (12.97%) and Hymenoptera (9.73%). Angelov *et al.* (1966) recorded spiders and beetles as predominating food source for *P. tauricus* and that the majority of spiders are caught during the spring. The same authors recorded Coleoptera and partly Orthoptera as the major food source for *L. viridis,* also pointing out the high percentage of the spiders. Kabisch, Engelmann (1970) recorded Hemiptera (27.6%), Coleoptera (17.2%) and Hymenoptera (14.1%) as major prey groups for *P. tauricus*, also noting the relatively high percentage of the spiders. According to Angelov *et al.* (1972b) the predominating food type for Balkan wall lizard is Coleoptera (43.56%), especially Carabidae family, followed by Lepidoptera (larvae) (16.33%) and Aranei (14.29%). For Green lizard Angelov *et al.* (1972a) reported Coleoptera, Lepidoptera and Hymenoptera as major food sources, while Donev (1984b) registered Coleoptera, Diptera and Crustacea as predominating food. Donev (1984a) also reported Coleoptera as the major food source for *P. tauricus*, followed by Aranei, Hemiptera and Hymenoptera. According to Donev *et al.* (2005) the predominating preys in the trophic spectrum of *P. tauricus* are Coleoptera, Diptera and Aranei and for *L. viridis* – Coleoptera, Lepidoptera (larvae), Orthoptera and Aranei.

Our results confirm the results obtained by other authors and the imago of Coleoptera should be considered as the most important food source for both lizard species. It seems both species prefer imago and feed less on larvae, except in the spring when the larvae of some insects are with higher abundance, heads easy prey. Redford, Dorea (1984) claimed that adult insects do not vary much as nutrition content but still it is considered that the larvae and pupae elements of holometabolic insects are rich in lipids and thus, more nutritive (Brooks *et al.* 1996). The higher percentage of Orthoptera, registered in the current study in both species, could be explained by habitat types of the localities, where the material was collected – the area is mainly arable land from semi-mountain type. The beetles, grasshoppers and spiders 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).

The seasonal variation of food of both species is presented in Table 3 and 4. For the whole period of study Balkan wall lizard shows highest feeding activity (number of eaten prey items) in the early autumn (September), while Green lizard – during the summer (July-August). The results registered by Angelov *et al.* (1966) and Donev (1984a) showed that the trophic spectrum of *P. tauricus* is much more diverse during the spring with predominating Coleoptera, while during the summer this species prefers Hemiptera and Orthoptera. Angelov *et al*. (1972a) reported similar results for *L. viridis* – the diet of Green lizard is much more diverse in the spring, consisting of beetles and larvae of Lepidoptera, with lower feeding activity among the lizards. During the summer the predominating food are beetles ants and spiders and the authors noted a higher feeding activity among the lizards, which they explain with the higher temperatures during that season. Similar results were reported by Donev (1984b). None of the above mentioned authors conducted studies on the trophic spectrum of these two species, which extend to the autumn season. According to our results *P. tauricus* shows the highest feeding activity and most diverse diet in September. That's probably why September differs in separate cluster with approximately 55% similarity (Fig. 2). May (spring season) is separated next with

Table 1. Descriptive statistics of the diet of *Podarcis tauricus* and *Lacerta viridis* for the whole period of study.

Species	Number of stomachs	Number of prey categories	Number of prey items	Mean	Standard Deviation (SD)	Standard Error (SE)
Podarcis tauricus	120	19	195	10.26	19.82	4.55
Lacerta viridis	110		185	9.74	14.34	3.29

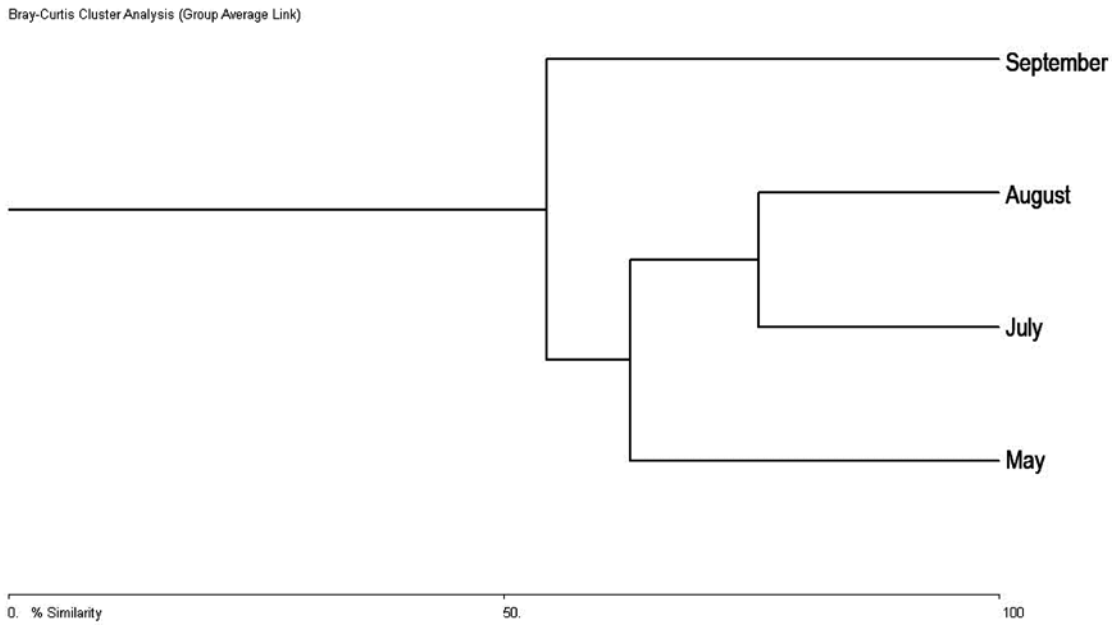

Fig. 2. Cluster analysis of the seasonal distribution of the trophic spectrum of *Podarcis tauricus* for the whole period of study (Bray-Curtis index, group average link).

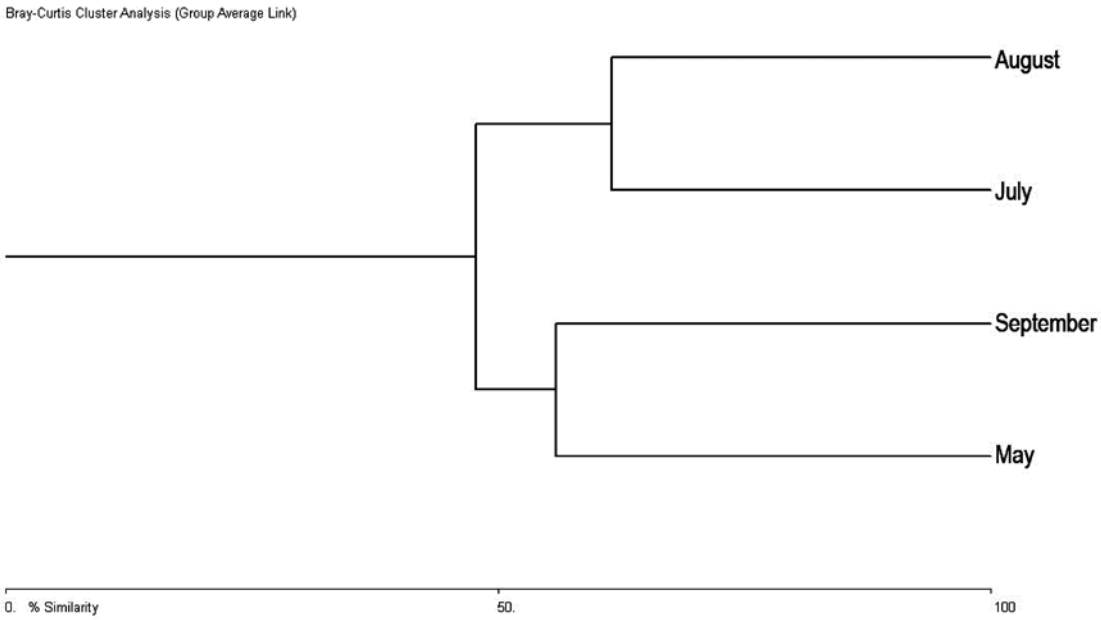

Fig. 3. Cluster analysis of the seasonal distribution of the trophic spectrum of *Lacerta viridis* for the whole period of study (Bray-Curtis index, group average link).

about 60% similarity and July and August (summer season) are grouped together with about 75% similarity. The reason for the high feeding activity in the autumn is perhaps the need of this species to accumulate nutrients before the winter hibernation. The Green lizard on the other hand exhibited highest feeding activity during the summer, according to our results, as it was also pointed out by Angelov *et al*. (1972a) and Donev (1984b). The results from the cluster analysis showed a grouping of May and September with about 55% similarity and the summer season (July-August) at about 60% similarity (Fig. 3). Perhaps during the summer, due to the higher temperatures, the lizards and also most of insects are more active, thus the registered higher proportions in their diet during this season (Table 3, 4).

Table 2. Qualitative and quantitative contents of the diet of *Podarcis tauricus* and *Lacerta viridis* for the whole period of study. Legend: n – number of prey items; n % – numeric proportion; f % – frequency of occurrence.

Prey taxa	*P. tauricus*			*L. viridis*		
	n	n %	f %	n	n %	f %
Gastropoda	1	0.51	0.83	2	1.08	1.82
Crustacea	2	1.03	1.67	3	1.62	2.73
Aranei	11	5.64	7.50	10	5.41	7.27
Myriapoda	0	0.00	0.00	2	1.08	1.82
Insecta						
Insecta (larvae)	2	1.03	0.83	3	1.62	1.82
Apterigota	3	1.54	2.50	0	0.00	0.00
Orthoptera	87	44.62	57.50	63	34.05	32.73
Dermaptera	0	0.00	0.00	1	0.54	0.91
Hemiptera	14	7.18	10.00	4	2.16	3.64
Hymenoptera – undet.	8	4.10	5.00	18	9.73	10.00
Formicidae	13	6.67	6.67	9	4.86	4.55
Diptera.	9	4.62	5.83	15	8.11	12.73
Coleoptera – undet.	28	14.36	19.17	24	12.97	12.73
Carabidae	5	2.56	3.33	8	4.32	5.45
Scarabaeidae	2	1.03	1.67	5	2.70	3.64
Cerambicidae	0	0.00	0.00	4	2.16	0.91
Histeridae	1	0.51	0.83	7	3.78	2.73
Lepidoptera	4	2.05	3.33	2	1.08	1.82
Lepidoptera (larvae)	5	2.56	4.17	5	2.70	3.64
Sampling adequacy (Lehner's index)	0.875			0.945		
Berger-Parker index	0.446			0.341		
Niche breadth (1/Simpson)	4.261			6.403		
Niche overlap	82.30%					

Although we registered a slight preference of both species towards Orthoptera, Berger-Parker index showed a moderate to low value (Table 2). The trophic niche breadth for both species, calculated from our results showed a low value for *P. tauricus* and moderate value for *L. viridis* (Table 2). The trophic niche breadth for *P. tauricus*, calculated from the results from other authors is as follows: 3.73 (after Angelov *et al.* 1966); 14.87 (after Angelov *et al.* 1972b); 5.87 (after Donev 1984a); 9.98 (after Donev *et al.* (2005) and for *L. viridis*: 2.89 (after Angelov *et al.* 1966); 5.10 (after Angelov *et al.* 1972a); 19.41 (after Donev 1984b); 4.13 (after Donev *et al.* 2005). Our results confirm the results obtained from the other authors – both lizards have very similar trophic niche breadths. This lead us to the conclusion that both species should be considered general feeders (polyphages) with slight preference towards Coleoptera, Orthoptera or other taxa, depending of the season and habitat.

We calculated a niche overlap between the two species (after Pianka's formula) – 82.30%. The t-test for independent samples also showed no statistically significant differences in the diet of the two species (t=0.45, df=36, p=0.66). According to our results there should be a considerable competition for food between *P. tauricus* and *L. viridis* at the places with sympatric distribution.

Conclusions

During our study we analysed the contents of 120 specimens of *P. tauricus* and 110 specimens of *L. viridis,* which contained 195 and 184 prey items, respectively. The average number of prey items per stomach for the studied lizard species is very similar: *P. tauricus* – 1.63; *L. viridis* – 1.68.

The main food source for both lizards is insects. For *P. tauricus* the predominating food type is Orthoptera (44.62%), followed by Coleoptera (14.36%) and Hemiptera (7.18%) and from the diet of *L. viridis* predominating are again Orthoptera (34.05%), followed by Coleoptera (12.97%) and Hymenoptera (9.73%).

Table 3. Seasonal distribution (May and July) of the diet of *Podarcis tauricus* and *Lacerta viridis* from South Bulgaria, for the whole period of study. Legend: n – number of prey items; n % – numeric proportion; f % – frequency of occurrence.

Prey taxa	May												July											
	1980						1981						1980						1981					
	P. tauricus			*L. viridis*			*P. tauricus*			*L. viridis*			*P. tauricus*			*L. viridis*			*P. tauricus*			*L. viridis*		
	n	**n %**	**f %**	**n**	**n %**	**f %**	n	n %	f %	n	n %	f %	n	n %	f %	n	n %	f %	n	n %	f %	n	n %	f %
Gastropoda	-	0.00	0.00	1	6.67	0.91	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	3.33	0.91	-	0.00	0.00	-	0.00	0.00
Crustacea	-	0.00	0.00	-	0.00	0.00	1	4.76	0.83	-	0.00	0.00	-	0.00	0.00	1	3.33	0.91	-	0.00	0.00	-	0.00	0.00
Aranei	2	11.76	1.67	-	0.00	0.00	2	9.52	0.83	2	13.33	1.82	3	13.04	1.67	2	6.67	1.82	-	0.00	0.00	1	2.94	0.91
Myriapoda	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Insecta																								
Insecta (larvae)	-	0.00	0.00	-	0.00	0.00	2	9.52	0.83	-	0.00	0.00	-	0.00	0.00	2	6.67	0.91	-	0.00	0.00	-	0.00	0.00
Apterigota	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Orthoptera	6	35.29	3.33	8	53.33	4.55	8	38.10	5.00	6	40.00	3.64	10	43.48	7.50	3	10.00	1.82	7	53.85	4.17	11	32.35	2.73
Dermaptera	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Hemiptera	2	11.76	0.83	1	6.67	0.91	-	0.00	0.00	1	6.67	0.91	1	4.35	0.83	-	0.00	0.00	2	15.38	1.67	1	2.94	0.91
Hymenoptera – undet.	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	4.35	0.83	1	3.33	0.91	-	0.00	0.00	4	11.76	1.82
Formicidae	3	17.65	1.67	-	0.00	0.00	2	9.52	0.83	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	2	15.38	0.83	2	5.88	0.91
Diptera.	1	5.88	0.83	-	0.00	0.00	2	9.52	0.83	2	13.33	1.82	1	4.35	0.83	-	0.00	0.00	-	0.00	0.00	4	11.76	3.64
Coleoptera – undet.	-	0.00	0.00	-	0.00	0.00	2	9.52	1.67	-	0.00	0.00	6	26.09	3.33	3	10.00	2.73	1	7.69	0.83	6	17.65	2.73
Carabidae	2	11.76	0.83	4	26.67	1.82	-	0.00	0.00	2	13.33	1.82	-	0.00	0.00	2	6.67	1.82	-	0.00	0.00	-	0.00	0.00
Scarabaeidae	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	6.67	0.91	-	0.00	0.00	1	3.33	0.91	-	0.00	0.00	3	8.82	1.82
Cerambicidae	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	4	13.33	0.91	-	0.00	0.00	-	0.00	0.00
Histeridae	-	0.00	0.00	-	0.00	0.00	1	4.76	0.83	-	0.00	0.00	-	0.00	0.00	7	23.33	2.73	-	0.00	0.00	-	0.00	0.00
Lepidoptera	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	4.35	0.83	-	0.00	0.00	-	0.00	0.00	2	5.88	1.82
Lepidoptera (larvae)	1	5.88	0.83	1	6.67	0.91	1	4.76	0.83	1	6.67	0.91	-	0.00	0.00	3	10.00	1.82	1	7.69	0.83	-	0.00	0.00
Total	17	100	-	15	100	-	21	100	-	15	100	-	23	100	-	30	100	-	13	100	-	34	100	-
Total per season (*P.t.*)	38												36											
Total per season (*L.v.*)	30												64											

Table 4. Seasonal distribution (August and September) of the diet of *Podarcis tauricus* and *Lacerta viridis* from South Bulgaria, for the whole period of study. Legend: n – number of prey items; n % – numeric proportion; f % – frequency of occurrence.

Prey taxa	August												September											
	1980						1981						1980						1981					
	P. tauricus			*L. viridis*			*P. tauricus*			*L. viridis*			*P. tauricus*			*L. viridis*			*P. tauricus*			*L. viridis*		
	n	**n %**	**f %**	**n**	**n %**	**f %**	**n**	**n %**	**f %**	**n**	n %	f %	n	n %	f %	n	n %	f %	n	n %	f %	n	n %	f %
Gastropoda	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	2.13	0.83	-	0.00	0.00
Crustacea	-	0.00	0.00	2	6.25	1.82	-	0.00	0.00	-	0.00	0.00	1	2.78	0.83	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Aranei	-	0.00	0.00	1	3.13	0.91	1	5.00	0.83	2	9.52	0.91	1	2.78	0.83	2	6.25	0.91	2	4.26	1.67	-	0.00	0.00
Myriapoda	-	0.00	0.00	1	3.13	0.91	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	16.67	0.91
Insecta																								
Insecta (larvae)	-	0.00	0.00	1	3.13	0.91	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Apterigota	2	11.11	1.67	-	0.00	0.00	1	5.00	0.83	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Orthoptera	8	44.44	5.00	3	9.38	1.82	11	55.00	7.50	8	38.10	6.36	15	41.67	12.50	22	68.75	10.91	22	46.81	12.50	2	33.33	0.91
Dermaptera	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	3.13	0.91	-	0.00	0.00	-	0.00	0.00
Hemiptera	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	5	13.89	4.17	1	3.13	0.91	4	8.51	2.50	-	0.00	0.00
Hymenoptera – undet.	1	5.56	0.83	11	34.38	5.45	1	5.00	0.83	1	4.76	0.91	1	2.78	0.83	1	3.13	0.91	4	8.51	1.67	-	0.00	0.00
Formicidae	-	0.00	0.00	2	6.25	0.91	-	0.00	0.00	3	14.29	0.91	4	11.11	2.50	2	6.25	1.82	2	4.26	0.83	-	0.00	0.00
Diptera.	-	0.00	0.00	4	12.50	3.64	3	15.00	1.67	2	9.52	1.82	2	5.56	1.67	-	0.00	0.00	-	0.00	0.00	3	50.00	1.82
Coleoptera – undet.	6	33.33	2.50	7	21.88	3.64	1	5.00	0.83	5	23.81	1.82	3	8.33	2.50	3	9.38	1.82	9	19.15	7.50	-	0.00	0.00
Carabidae	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	2	5.56	1.67	-	0.00	0.00	1	2.13	0.83	-	0.00	0.00
Scarabaeidae	-	0.00	0.00	-	0.00	0.00	1	5.00	0.83	-	0.00	0.00	1	2.78	0.83	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Cerambicidae	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Histeridae	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Lepidoptera	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	1	2.78	0.83	-	0.00	0.00	2	4.26	1.67	-	0.00	0.00
Lepidoptera (larvae)	1	5.56	0.83	-	0.00	0.00	1	5.00	0.83	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
Total	18	100	-	32	100	-	20	100	-	21	100	-	36	100	-	32	100	-	47	100	-	6	100	-
Total per season (*P.t.*)	38												83											
Total per season (*L.v.*)	53												38											

For the whole period of study the seasonal variation of the diet of Balkan wall lizard showed highest feeding activity (number of eaten prey items) in early autumn (September), while Green lizard – during the summer (July-August).

Berger-Parker index showed a low to moderate value for both species, although a slight preference to a certain taxon or taxa depending on the habitat or season may be observed.

The calculated trophic niche breadth for the two studies lizard species is as follows: *P. tauricus* – 4.26 and for *L. viridis* – 6.40. The trophic niche overlap between the two species is 82.30% and in our opinion there should be a considerable competition for food resources among these species at the places with sympatric distribution.

Achnowedgements: We would like to express our sincerest gratitude to Prof. Blagoy Gruev, DSc and Assoc. Prof. Dr. Vasil Tomov for the given data and their insights used in this manuscript and Mr. Peter Ganev for his help during the field work and the laboratory analysis.

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