

## Another contribution to the knowledge of the trophic spectrum of few lacertid lizards (Reptilia, Squamata, Lacertidae) from Southern Bulgaria

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**Abstract.** We present unpublished data on the diet of three lizards (*Lacerta trilineata*, *Lacerta agilis* and *Podarcis tauricus*) from the Lacertidae family, collected in 1974 in few localities in Southern Bulgaria. The analyzed data showed that the insects (Insecta) are the most numerous and the most frequently met food component and among the non-insect components the spiders and isopods are slightly predominating. The largest niche breadth was recorded in *Podarcis tauricus* (6.135), followed by *Lacerta trilineata* (5.263) and *Lacerta agilis* (4.132). All three studied lacertid species are classified as opportunistic general feeders (polyphages), which may show slight preference towards beetles, ants or spiders, depending on the occupied habitat or the season.

**Key-words:** Lacertidae, diet, Southern Bulgaria.

### Introduction

The feeding ecology and behavior is important aspect of the ecological studies and currently there is still a big gap of knowledge concerning the Bulgarian lizards (Mollov & Petrova 2013). The aim of the this short note is to supplement the data about the trophic spectrum of three lizards from the Lacertidae family (*Lacerta trilineata*, *Lacerta agilis* and *Podarcis tauricus*), by presenting previously unpublished data about their diet.

### Material and Methods

The analyzed material is from 18 specimens, belonging to the following species: *Lacerta trilineata* (5 ind.), collected on 08.05.1974 from the area of Septemvri Town (Pazardzhik District, UTM KG67); *Lacerta agilis* (6 ind.), collected on 16.08.1974 from the area of Smolyan Lakes Cabin (Smolyan District, UTM LG00) and *Podarcis tauricus* (7 spec.), collected on 07.05.1974 from Plovdiv City, The Rowing Canal Area (former „Ostrova“, UTM LG16). The material was collected and determined by the late Assoc. Prof. Atanas Donev<sup>†</sup>, PhD and the data (previously unpublished) kept in the Department of Zoology, Faculty of Biology at the University of Plovdiv "Paisii Hilendarski".

Sampling adequacy was determined using Lehner's formula (Lehner 1996).

The diversity of the diet (niche breadth) was calculated for each species, using the reciprocal value of the Simpson's diversity index (Magurran 1988).

To determine the level of the food specialization of each species we used the index of dominance of Berger-Parker (d), calculated by the following formula (Magurran 1988).

The results were statistically processed using descriptive statistics and for the statistical processing of the data we used the software package "PAST" ver. 4.03 (Hammer *et*

al. 2001). For the calculations of Simpson's diversity index and the Berger-Parker index we used the computer software "BioDiversityPro" (McAleece *et al.* 1997).

### Results and Discussion

The analyzed stomach contents of a total of 17 stomachs contained 72 prey items, divided into 16 prey categories (Table 1). According to the obtained results the Sand lizard shows the highest feeding activity, but since the material is collected in only one season, an analysis on seasonal dynamics of the trophic spectrum, for either of the species, cannot be done. Table 2 presents the qualitative and quantitative proportion of the diet of the three studied lizard species. The insects are the predominating prey in all three species, except for the Sand lizard, where the spiders are predominating.

For *Lacerta trilineata* the predominating food type were insects (64.71%), while the rest of the registered food items were spiders (35.29%). The Berger-Parker index showed a low value - 0.353 and the trophic niche breadth is moderate (5.263) (Table 2). There are only three other studies conducted on the trophic spectrum of *Lacerta trilineata* in Bulgaria so far (Peters 1963; Angelov *et al.* 1966 and Mollov & Petrova 2013). The first author (based on 62 ind. from the area of Slanchev bruag Resort) reported that the predominated prey are Hymenoptera, Formicidae (40.4%), followed by Coleoptera + larvae (21.6%) and Diptera, Muscidae (8.8 %). Angelov *et al.* (1966) examined only 9 ind. from South Bulgaria and reported that the most important food type in the diet of *L. trilineata* again are again Hymenoptera, Formicidae (43.5%), followed by Coleoptera (28.3%) and Hemiptera (15.1%). According to the data by Mollov & Petrova (2013) (based on only 5 ind.), the most numerous food type in the diet is Coleoptera (50%), mainly the Carabidae and Dermestidae families, followed by Lepidoptera (larvae) (33.34%), Diptera, Muscidae and Araneae – 8.33% each. The trophic niche breadth calculated from their results is accordingly 4.34, 4.52 and 8.25. Our results differ from the previous two studies, conducted on the diet of this species, but according to Peters (1963) the presence of the ants in the diet of the Balkan Green lizard may vary depending on the habitat and the season. The fact that we did not record any ants in our samples (as well as the previous study Mollov & Petrova 2013) may be partially explained by this statement and also from the small sample size. In conclusion in our opinion *Lacerta trilineata* should be considered a general feeder (polyphage).

For *Lacerta agilis* the insects take 60.53% from the diet, but and the most important prey category was Araneae (34.21%), followed by Hemiptera (larvae) (31.58%). Angelov *et al.* (1966; 1972), both studies based on 12 examined stomachs from *Lacerta agilis*, reported that the most important prey are insects. Angelov *et al.* (1966) reported that the most numerous taxon is Coleoptera (50.00%), followed by Araneae (32.70%) and Lepidoptera-larvae (13.50%) and according to Angelov *et al.* (1972) the predominating prey is Orthoptera (44.12%), followed by Hymenoptera (14.71%) and Araneae (8.82%). Mollov & Petrova (2013) reported Araneae (51.85%), as the most important prey category, followed by Hemiptera (14.82%) and Coleoptera (14.81%). The trophic niche breadth calculated from the results from the previous studies varies between 2.75 and 5.24, which is close to our results. There is only other study on the trophic spectrum of the sand lizard in Bulgaria, conducted by Donev *et al.* (2005), based only on two specimens and according to their results the predominating prey taxa is Coleoptera (40%). Depending on the habitat and the season the predominating prey type may vary, but in our opinion the sand lizard should be considered a polyphage, with slight preference towards spiders and beetles and with low to moderate trophic niche breadth.

**Table 1.** Descriptive statistics of the diet of the three studied lizard species.

Species	Number of stomachs	Number of prey categories	Number of prey items	Mean	Standard Deviation (SD)	Standard Error (SE)
<i>Lacerta trilineata</i>	5		17	1.06	1.57	0.39
<i>Lacerta agilis</i>	6	16	38	2.37	4.16	1.04
<i>Podarcis tauricus</i>	7		17	1.06	1.39	0.35

**Table 2.** Qualitative and quantitative contents of the diet of the three studied species of lizards. Legend: n – number of food components, s – number of stomachs.

Prey taxa	<i>Lacerta trilineata</i>				<i>Lacerta agilis</i>				<i>Podarcis tauricus</i>			
	n	n%	s	s%	n	n%	s	s%	n	n%	s	s%
Arachnida, Araneae	6	35.29	4	33.33	13	34.21	5	31.25	4	23.53	3	27.27
Isopoda, Oniscidae	-	-	-	-	2	2.63	1	6.25	-	-	-	-
Hemiptera - undet.	-	-	-	-	1	13.16	1	6.25	-	-	-	-
Cicadellidae	-	-	-	-	5	31.58	2	12.50	-	-	-	-
Hemiptera, Auchenorrhyncha (larvae)	-	-	-	-	12	5.26	3	18.75	-	-	-	-
Diptera – undet.	-	-	-	-	2	2.63	1	6.25	2	11.76	1	9.09
Coleoptera – undet.	2	11.76	1	8.33	1	-	1	6.25	2	11.76	1	9.09
Carabidae	1	5.88	1	8.33	-	-	-	-	1	5.88	1	9.09
Coccinellidae	-	-	-	-	-	-	-	-	1	5.88	1	9.09
Curculionidae	-	-	-	-	-	-	-	-	2	11.76	1	9.09
<i>Trachyphloeus sp.</i>	-	-	-	-	-	-	-	-	1	5.88	1	9.09
Dermestidae, <i>Dermestes sp.</i>	2	11.76	1	8.33	-	2.63	-	-	-	-	-	-
Elateridae	2	11.76	2	16.67	1	-	1	6.25	-	-	-	-
Coleoptera (larvae)	1	5.88	1	8.33	-	-	-	-	-	-	-	-
Silphidae (larvae)	1	5.88	1	8.33	-	2.63	-	-	-	-	-	-
Lepidoptera (larvae)	2	11.76	1	8.33	1	-	1	6.25	4	23.53	2	18.18
<b>Lehner's index</b>	<b>0.625</b>				<b>0.666</b>				<b>0.625</b>			
<b>Berger-Parker index</b>	<b>0.353</b>				<b>0.342</b>				<b>0.235</b>			
<b>Niche breadth (1/Simpson)</b>	<b>5.263</b>				<b>4.132</b>				<b>6.135</b>			

For *Podarcis tauricus* the predominating food type were insects (76.47%), where the most numerous taxa were Coleoptera and Lepidoptera (larvae) (23.53%) and Araneae (23.53%). 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. Kabisch & Engelmann (1970) recorded Hemiptera (27.6%), Coleoptera (17.2%) and Hymenoptera (14.1%) as major prey groups, also noting the relatively high percentage of the spiders. According to Angelov et al. (1972) 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%). Similar results were reported by Donev (1984) - the predominating food was insects (77.38%), consisted mostly by Coleoptera and from the non-insect taxa, Aranea were predominating (29.76%). Mollov et al. (2012) reported Orthoptera (44.62%), followed by Coleoptera (14.36%) and Hemiptera (7.18%) as the three predominating prey

categories for *P. tauricus*. The Balkan Wall lizard also can be classified as polyphage with moderate trophic niche breadth.

In conclusion the three studied lacertid lizards are opportunistic general feeders (polyphages), which may show slight preference towards beetles, ants or spiders, depending on the occupied habitat or the season. The beetles, ants and spiders are basic food for the three studied species of lizards, most probably due to the abundance of this preys and the wide range of habitats where they can be found (Mollov 2008).

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