DATA ON THE FOOD COMPOSITION OF FOUR LIZARD SPECIES (REPTILIA: LACERTIDAE) ACCIDENTALLY FALLEN IN PITFALL TRAPS IN WESTERN ROMANIA

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Abstract. We studied the food composition of 39 individuals belonging to four lizard species (*Lacerta viridis*, *Lacerta agilis*, *Podarcis tauricus*, *Zootoca vivipara*). The studied lizards accidentally fell in pitfall traps installed in north-western Romania (Bihor and Satu-Mare counties) in the years 2004, 2008, and 2009. Among the 39 lizards, only three did not have stomach contents. Only in the case of *P. tauricus* all studied individuals had stomach contents. *L. agilis* had a higher food diversity, as it consumed preys that were larger, harder, and more rigid compared with the other species. At the opposite pole, *Z. vivipara* had a lower feeding intensity; it consumed a lot of soft and small-sized preys, as its feeding is focused primarily on spiders. The low feeding intensity of *Z. vivipara* could be a consequence of the fact that in the region, it is distributed in plain areas, thus at an unusual altitude for this species in Romania. *P. tauricus* had a food composition that reflects the peculiarities of the habitats it populates in north-western Romania, namely areas with sandy soil. In the case of *L. viridis*, the reduced food composition and diversity is probably a consequence of the small number of individuals identified in the pitfall traps. Our results indicated the importance of the university scientific collections in offering complex information and that even the lizards accidentally collected in pitfall traps can offer numerous information on them, just like those originating from road mortality.

Keywords: size, ecology, habitat, feeding behavior, reptiles.

Rezumat. Date asupra spectrului trofic a patru specii de șopârle (Reptilia: Lacertidae) căzute accidental în capcane de sol în vestul României. Am studiat compoziția hranei la 39 de indivizi aparținând la patru specii de șopârle (*Lacerta viridis, Lacerta agilis, Podarcis tauricus, Zootoca vivipara*). Șopârlele studiate au căzut accidental în capcanele de sol instalate în nord-vestul României (județele Bihor și Satu-Mare) în anii 2004, 2008 și 2009. Dintre cele 39 de șopârle numai trei nu au avut conținut stomacal. *L. agilis* a avut o diversitate mai mare a hranei, aceasta consumând prăzi mai mari, mai dure și mai rigide în comparație cu celelalte specii. La polul opus, *Z. vivipara* a avut o intensitate mai mică a hrănirii, consumând multe prăzi moi și de dimensiuni reduse, hrănirea sa fiind bazată în mod primordial pe păianjeni. Intensitatea scăzută a hrănirii în cazul speciei *Z. vivipara* poate să fie o consecință a faptului că în regiune aceasta se află la câmpie, la o altitudine neobișnuită pentru această specie în România. Compoziția hranei speciei *P. tauricus* reflectă particularitățile habitatelor populate în nord-vestul României, adică zone cu sol nisipos. În cazul speciei *L. viridis* compoziția redusă și diversitate scăzută a hranei este probabil o consecință a numărului mic de indivizi identificați în capcanele de sol. Rezultatele noastre indică importanța colecțiilor științifice universitare în a oferi informații complexe, precum și faptul că șopârlele căzute accidental în capcanele de sol pot oferi numeroase informații despre acestea, la fel ca cele provenite din mortalitatea rutieră.

Cuvinte cheie: mărime, ecologie, habitat, comportament de hrănire, reptile.

INTRODUCTION

Recent data also confirm in Romania that road-killed reptiles could offer valuable information about them (ILE et al., 2020), even their food composition (MAIER et al., 2020). This fact is important because, in Romania, there is only very little information on the lizards' food composition (SÎRBU, 1977, 1979; MAIER et al., 2020). Moreover, these data are generally old and obtained after the killing and dissection of animals captured alive (SÎRBU, 1977, 1979). The volume on the Romanian fauna dedicated to reptiles only includes general and vague information, probably taken from the literature, about the lizards' food composition (FUHN & VANCEA, 1961). Unlike these, the information regarding the amphibians' food composition is highly numerous in Romania, covering all species (e.g., SAS et al., 2009; CICORT-LUCACIU et al., 2011; BOGDAN et al., 2013; COVACIU-MARCOV et al., 2012; ROȘCA et al., 2013; MAIER et al., 2022). Knowing the above, we have wondered to what extent pitfall traps could offer helpful information regarding the food composition of some lizards that had accidentally fallen into them. This has been supported by the fact that in western Romania, approximately 20 years ago, several studies were made about different invertebrate groups using pitfall traps (TOMESCU et al., 2008; FERENȚI & DIMANCEA, 2012, 2013; FERENȚI & COVACIU-MARCOV, 2012; FERENȚI et al., 2012a, 2012b; SAS-KOVÁCS et al., 2015). The content of those traps is nowadays stored in the scientific collection of the University of Oradea. It is a well-known fact that the scientific collections held by universities or museums serve as a base for studies on the food composition of some reptile species (e.g., SHINE, 1988; MONTECHIARO et al., 2011; ÇIÇEK & GÖÇMEN, 2013; ÇIÇEK et al., 2014; SAGONAS et al., 2015), and this is also true for some lizard species that are also present in Romania, as *Lacerta viridis*, *Lacerta agilis*, *Podarcis tauricus* or *Podarcis muralis*, but those studies were made in other regions of their distribution range (MOLLOV et al., 2012; MOLLOV & PETROVA, 2013; MOLLOV & BOYADZHIEV, 2021). Thus, we hypothesized that, if in the pitfall traps from western Romania, we would identify lizards that accidentally fell into them, the traps would also offer information about their food composition, not only about the invertebrate assemblages from the region.

Thus, the objectives of our study were the following: **1.** to identify and determine the lizard species accidentally fallen in the pitfall traps, **2.** to establish the food composition of those lizards, and **3.** to compare the food composition between species and with the literature.

MATERIAL AND METHODS

We have studied the food composition of 39 lizard individuals that belonged to four species: *Lacerta viridis*, *Lacerta agilis*, *Podarcis tauricus*, and *Zootoca vivipara*. The number of lizard individuals identified in the pitfall traps differed between the four species (Table 1). The lizards had accidentally fallen in pitfall traps that were installed in different areas of north-western Romania in the years 2004, 2008, and 2009 to collect some invertebrates, especially terrestrial isopods and spiders, some of those data being published (TOMESCU et al., 2008; FERENȚI & DIMANCEA, 2012, 2013; FERENȚI & COVACIU-MARCOV, 2012; FERENȚI et al., 2012a, 2012b; SAS-KOVÁCS et al., 2015). The pitfall traps were installed in different areas from the Bihor and Satu Mare counties, in the Oaș Mountains, Carei Plain, Livada Plain, Someș Plain, Crasna Hills, and areas neighboring the Beiuș Depression (TOMESCU et al., 2008; FERENȚI & DIMANCEA, 2012, 2013; FERENȚI & COVACIU-MARCOV, 2012; FERENȚI et al., 2012a, 2012b; SAS-KOVÁCS et al., 2015). The pitfall traps were made from plastic bottles buried in the soil, partially covered with metal covers, and collected once a month in the warm season (TOMESCU et al., 2008; FERENȚI & COVACIU-MARCOV, 2012; FERENȚI et al., 2012a, 2012b). Subsequently, the contents of the pitfall traps were stored in jars and deposited in the zoological collection of the University of Oradea. Although the pitfall traps were covered with metallic covers, these did not capture only invertebrates, but sometimes accidentally, a few lizards had fallen into them, a fact that was observed directly, even on the field. Starting from those mentioned above, in December 2022, we verified all pitfall traps collected in the years 2004, 2008, and 2009, stored in the scientific collection of the University of Oradea, and searched them for lizards. The 39 lizards identified in those pitfall traps were determined to the species level. Subsequently, the lizards were dissected, and their stomach was collected, as in other cases (MAIER et al., 2020). The stomach content was displayed on the stereomicroscope, and the preys were determined at the lowest possible taxonomic level, as in other cases (e.g., ANGELICI et al., 1997; HARDY & CRNKOVIC, 2006; SAGONAS et al., 2018; MAIER et al., 2020). Subsequently, we established the number of preys, the maximum and the average number of preys/individuals in the case of each species, but also the food diversity of each species with the Shannon index. Also, we have calculated the percentage abundance and the frequency of occurrence of each stomach content category in the case of each species. Finally, we have calculated the significance of the differences in the food composition between the four lizard species with the Mann-Whitney test and the similarity of food composition between the four species with the Jaccard index. All calculations were made with the help of the Past software (HAMMER et al., 2001).

RESULTS

Among the 39 studied lizard individuals, only four did not have stomach contents. Only in the case of *P. tauricus* all studied individuals had stomach contents (Table 1). The four lizard species from the pitfall traps from western Romania consumed a total of 168 preys. *L. agilis* consumed the highest number of preys, and the lowest number of preys was consumed by *L. viridis* (Table 1). The maximum number of preys consumed by a single individual was 18 in the case of *L. agilis*. Unlike this, in the case of *Z. vivipara,* the maximum number of preys/individual was only five (Table 1). There were differences in food diversity between the four studied species, as *L. agilis* consumed the most diverse food, and the least diverse food was consumed by *Z. vivipara* (Table 1). Also, the number of consumed prey taxa was the highest in the case of *L. agilis*, and the lowest number of consumed prey taxa was registered by *L. viridis* (Table 1).

Table 1. The number of studied individuals, individuals with empty stomachs, the maximum and average number of preys/individual, the total number of preys, the number of prey taxa, and food diversity (Shannon Index).

	Lacerta viridis	***Lacerta agilis***	***Podarcis tauricus***	***Zootoca vivipara***
No. of individuals	5	13	9	12
Individuals with empty stomach	1	2	-	1
Maximum number of preys/individual	9	18	8	5
Average number of preys/individual	3.6	5.30	4.77	3.16
Total number of preys	18	69	43	38
Number of prey taxa	9	16	13	10
Prey diversity (Shannon index H)	2.043	2.351	2.226	1.843

The four studied lizard species consumed 23 prey taxa, all belonging to invertebrates. Among them, only six prey taxa were consumed by all four lizard species (Table 2). *L viridis* did not consume any prey taxa that were not consumed by the other lizard species. *L. agilis* was the only lizard species in which stomach contents we could determine more Coleoptera families (Table 2). Nevertheless, we cannot exclude the fact that the other lizards also consumed preys from those Coleoptera families, but because of their advanced stage of digestion, we could not determine them to a family level and just considered them as Coleoptera undetermined. *P. tauricus* consumed a prey

taxon absent from the other species' food, namely antlions larvae. *Z. vivipara* consumed two prey taxa absent from the other species' food, namely Blattodea and Brachicera larvae. The percentage abundance and the frequency of occurrence of the consumed prey taxa differed greatly between the four lizard species (Table 2). Nevertheless, in the case of all four species, spiders represented an important prey taxon, but in the case of *L. agilis*, Coleoptera registered a higher percentage abundance (Table 2). The highest percentage abundance of spiders was registered by *Z. vivipara*, of which food was greatly based on this prey taxa. Nevertheless, in the case of all four lizard species, none of the prey taxa had a percentage abundance higher than 50%, as their food was diverse. Besides animal prey, we identified vegetal remains and inorganic elements in the stomach contents of the four studied lizard species, of which frequency of occurrence varied depending on the species (Table 2).

Table 2. Percentage abundance and frequency of occurrence of the prey taxa and other ingested elements (vegetal fragments and inorganic elements) consumed by the four lizard species.

	Lacerta viridis		***Lacerta agilis***		***Podarcis tauricus***		***Zootoca vivipara***	
	P%	**f%**	**P%**	**f%**	**P%**	**f%**	**P%**	**f%**
Vegetal fragments	-	40.00	-	46.15	-	44.44	-	91.67
Inorganic elements	-	20.00	-	15.38	-	-	-	8.33
Araneida	22.22	60.00	15.94	69.23	30.23	66.67	42.11	75.00
Opilionida	-	-	-	-	-	-	-	-
Acari	-	-	2.89	15.38	4.65	11.11	13.16	16.67
Diplopoda	5.55	20.00	-	-	4.65	22.22	-	-
Blattodea	-	-	-	-	-	-	2.63	8.33
Orthoptera	5.55	20.00	2.89	15.38	2.32	11.11	5.26	16.67
Coleoptera Carabidae	-	-	1.44	7.69	-	-	-	-
Coleoptera Elateridae	-	-	18.84	30.77	-	-	-	-
Coleoptera Staphylinidae	-	-	1.44	7.69	-	-	-	-
Coleoptera Chrysomelodae	-	-	2.89	15.38	-	-	-	-
Coleoptera Curculionidae	-	-	1.44	7.69	-	-	-	-
Coleoptera undetermined	5.55	20.00	18.84	69.23	6.97	22.22	10.53	33.33
Coleoptera larvae	-	-	2.89	15.38	9.30	22.22	-	-
Diptera Nematocera	-	-	-	-	-	-	2.63	8.33
Diptera Brachycera	-	-	1.44	7.69	4.65	22.22	-	-
Diptera Brachycera larvae	-	-	-	-	-	-	2.63	8.33
Lepidoptera	-	-	-	-	2.32	11.11	-	-
Lepidoptera larvae	11.11	40.00	8.69	30.77	16.28	33.33	2.63	8.33
Hymenoptera Formicidae	5.55	20.00	2.89	7.69	2.32	11.11	10.53	25.00
Hymenoptera undetermined	11.11	20.00	1.44	7.69	-	-	-	-
Neuroptera Myrmeleontidea larvae	-	-	-	-	4.65	22.22	-	-
Auchenorrhyncha	11.11	20.00	5.79	23.08	4.65	11.11	7.89	16.67
Sternorrhyncha	22.22	20.00	10.14	7.69	6.97	22.22	-	-

In the case of the significance of differences between the food composition of the four lizard species, the only significant differences were found, according to the Mann-Whitney test, between *L. agilis* and *L. viridis* ($p=0.021$). In the case of the other species, the differences in terms of food composition were not significant according to the Mann-Whitney test ($p>0.05$). According to the Jaccard similarity index, the most similar food composition was registered between *P. tauricus* on one side and *L. agilis* and *L. viridis* on the other side. The most different food composition was registered by *Z. vivipara* (Fig. 1).

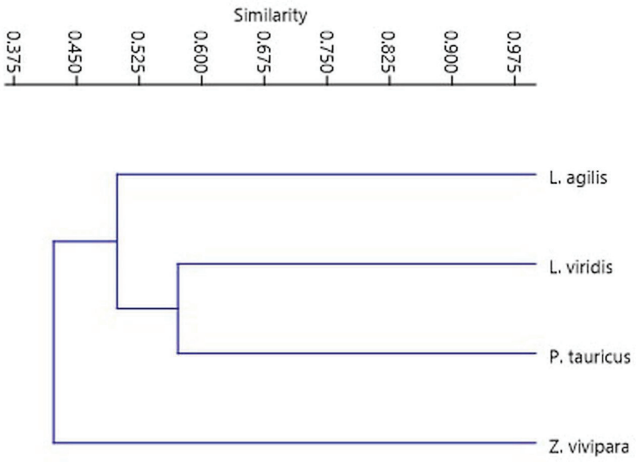

Figure 1. The Jaccard similarity between the trophic spectrum of the four lizard species.

DISCUSSION

The lizards that accidentally fell into the pitfall traps in western Romania could offer useful information about their feeding behavior, just as road-killed lizards had done previously (MAIER et al., 2020). The only species in which all studied individuals presented stomach contents was *P. tauricus*. Among the other species, *L. agilis* had two individuals without food, and the other two species each had one without food. The presence of individuals without stomach contents may be a consequence of the fact that the studied lizards were accidentally captured with pitfall traps because, in the case of a larger number of road-killed European green lizards, all studied individuals had stomach contents (MAIER et al., 2020). This is relevant because, in the case of road mortality, the time passed between the animal's death and the moment it was preserved could sometimes be long (MAIER et al., 2020), but in the case of pitfall traps, lizards were immediately preserved in the traps. It is possible that some individuals identified in the pitfall traps vomited their food when they accidentally fell into the trap. At the same time, it is possible that individuals without food had not eaten before falling into the trap. This assumption is supported by the fact that, in other cases as well, lizards without food were identified (e.g., SÎRBU, 1979; CASTILLA et al., 1991; HARDY & CRNKOVIC, 2006). In the case of amphibians, the number of individuals with empty stomachs is sometimes high, but usually in periods with unfavourable conditions (e.g., COVACIU-MARCOV et al., 2005, 2010; KOPECKÝ et al., 2012). Nevertheless, this fact is ruled out in our case because the European green lizard without stomach content was captured in June, in the middle of this species' activity period (FUHN & VANCEA, 1961). Moreover, we found another *L. viridis* individual captured in the same month with stomach content. Also, in the case of *L. agilis* and *Z. vivipara*, the individuals without stomach contents were captured in the summer. Therefore, there is a possibility that individuals without food were an accidental presence. The possibility of the presence of some individuals without food composition is supported in the case of *Z. vivipara* by the fact that also in other cases in Romania, the percentage abundance of individuals without food was relatively high (six from 47) even in the case of individuals studied directly by dissection (SÎRBU, 1979).

Z. vivipara registered the lowest feeding intensity. Its food had the lowest taxa diversity, number of preys, and number of preys/individual, even if the number of lizards was almost equal with *L. agilis*, the species with the most intense feeding. This could be a consequence of the fact that, in the Carei Plain, the species is outside its normal distribution range in this part of the world, where it is considered a mountain lizard species (FUHN & VANCEA, 1961). Thus, the individuals from the pitfall traps offer information about the feeding of this species in a plain area, as the previous studies from Romania were realized in mountain areas (SÎRBU, 1977, 1979). The relict *Z. vivipara* populations identified in numerous locations in the north-western Romanian plains, albeit about 25 years ago, are strictly linked to relict marshes of the region (see: COVACIU-MARCOV et al., 2008). Therefore, these are threatened by the swamp draining activities, which led to the elimination of most of the wetlands in the region (e.g., POP, 1960; UJVÁRI, 1972; ARDELEAN & KARÁCSONYI, 2002), which are also impacted by the pesticides that affect both fish and amphibians (CUPȘA et al., 2020). Moreover, the drought of the last years also had a negative effect on the region's wetlands, which had possible repercussions on the viviparous lizard, as it influenced other animals linked to wetlands, such as water birds (GACHE, 2014). However, the species consumed the same preys as in the past in the mountains of western Romania (SÎRBU, 1977, 1979), which is within the typical distribution area of the species in the country (FUHN & VANCEA, 1961). In the studies mentioned above, in one case, spiders were the most important taxon in the viviparous lizards' food (SÎRBU, 1979), while, in the other research, spiders occupied the second place by importance (SÎRBU, 1977). Also, in other regions, the trophic spectrum of this species had approximately the same composition, with spiders as an important trophic element for them (AVERY, 1962, 1966; PILORGE, 1982; VACHEVA & NAUMOV, 2020). Therefore, our data confirm that these lizards' small size and head prevent them from consuming large preys with a hard exoskeleton such as Coleopterans; instead, they focus on smaller and soft-bodied preys (VACHEVA & NAUMOV, 2020), such as spiders that are softer than Coleopterans. In the case of other small-sized lizards, like *Darevskia praticola*, spiders had the highest percentage abundance (VACHEVA & NAUMOV, 2022), as it is a well-known fact that the size of the body and head can affect prey selection (VERWAIJEN et al., 2002). Also, the species consumed numerous small-sized preys as well, such as acari or ants. Nevertheless, the species did not eat ants in other cases, although it had the opportunity (AVERY, 1962); in our case, ants represented 10.35% of the food. Therefore, in our case, the size of the species limits the potential preys and shapes the trophic spectrum. Variations of the feeding spectrum by size were observed between adults and juveniles in the case of this species (SÎRBU, 1977; VACHEVA & NAUMOV, 2020), but also in other lizards (e.g., CASTILLA et al., 1991; CROVETTO & SALVIDIO, 2013; VACHEVA & NAUMOV, 2022) and even in some amphibians (e.g., LŐW & TÖRÖK, 1998; CICORT-LUCACIU et al., 2013; MAIA-CARNEIRO et al., 2013).

The fact that *L. viridis* was represented by the smallest number of individuals may be due to its size, as it is the biggest among the four studied lizards (FUHN & VANCEA, 1961). Therefore, it has restricted access to the pitfall traps covered by a metallic cap with a slight opening. In a trophic spectrum study based on individuals originating from road mortality, the number of available individuals was much greater (MAIER et al., 2020). The best-represented species in the pitfall traps was *L. agilis*, a common species in Romania (COGĂLNICEANU et al., 2013), much more frequent in the area than *Z. vivipara* and *P. tauricus*, which are linked to special habitats and conditions, at least in the region our samples came from (COVACIU-MARCOV et al., 2009). *L. viridis* does not have sufficient favourable habitats in the

region, as in other parts of Romania, it was observed in habitats with shrubs, avoiding forest plantations and open areas (SEVIANU et al., 2022), habitats which predominate in Carei Plain. The small number of available *L. viridis* individuals and the fact that some of them did not have stomach content caused the poor and somehow different feeding of this species compared to what was previously registered in Romania (MAIER et al., 2020). Individuals of *L. viridis* consuming large-sized trophic elements were observed recently in Romania, with one individual ingesting partially a small-sized lizard such as *P. muralis* (LEU & PETROVAN, 2022). While the sample size of the European green lizard was low, the most intense feeding was registered in *L. agilis*, a situation also reported in other cases (MOLLOV & BOYADZHIEV, 2021). This species, too, is large and massive, and even though smaller than *L. viridis*, it is larger than *P. tauricus* or *Z. vivipara* (FUHN & VANCEA, 1961). Thereby, *L. agilis* not only had the most intense feeding, but it was the only species that ingested large-sized preys such as Coleoptera Carabidae, Elateridae, and others, which have, besides their increased size, a hard and rigid exoskeleton (RADU & RADU, 1967). However, there were cases when this species also consumed other types of preys, such as spiders (MOLLOV & PETROVA, 2013). Although *L. agilis* was present in the same locations as *P. tauricus* and *Z. vivipara*, its feeding differed much from the other two species. This cannot be only due to the difference in size between the species (FUHN & VANCEA, 1961) but also due to differences in habitat (FUHN & VANCEA, 1961; COVACIU-MARCOV et al., 2008, 2009). Thus, in north-western Romania, *P. tauricus* and *Z. vivipara* have well-delimited and strict habitats, as they are situated at the limit of their distribution and ecological range (COVACIU-MARCOV et al., 2009), while *L. agilis* is a common species in the region, recorded frequently (COGĂLNICEANU et al., 2013). Therefore, this species is situated at its ease in terms of both zoogeography and ecology and uses a wide range of habitats, also cohabiting with the other two species. Although between *L. agilis* and *Z. vivipara* a tendency for mutual ecological exclusion seems to exist also in some other parts of their distribution range, this is rather incomplete, as both have available suitable habitats (GLANDT, 1976), and the differences between the food composition seem to indicate the way these two species can be syntopic. Still, even if it is the species that consumed the most preys, *L. agilis* also fed on small-sized preys such as acari or aphids. The number of prey taxa consumed by *L. agilis* in north-western Romania was the same as in the case of a population in the Italian Alps, at an altitude of 1600 meters, with some differences in the percentage abundance of preys (CROVETTO & SALVIDIO, 2013).

Even if *P. tauricus* has an intermediate feeding in terms of intensity compared to the other three species, the taxa composition shows a highly specific feeding according to its habitat in the region. Thus, *P. tauricus* was the only species that consumed antlion larvae. This can be a consequence of the fact that, at least in north-western Romania, this species is present strictly in areas with sandy soil on Carei Plain, a habitat that favoured its expansion in the area (COVACIU-MARCOV et al., 2009). In other areas where the species was recently recorded at the limit of its distribution range, its presence was also considered to be due to this soil type (FISCHER et al., 2019). Thus, in its habitat, the species come into contact with antlion larvae, which are, in many cases, psammophilous (MANSELL, 1999). It is remarkable, though, that in some cases, these larvae are buried in their funnels made of sand (RADU & RADU, 1967) and are carnivorous (RADU & RADU, 1967; MANSELL, 1999), yet the nine *P. tauricus* individuals consumed two antlion larvae. Even if, to our knowledge, information on *P. tauricus* consuming this prey type is not available from Romania, the presence of Myrmeleontidae (without mentioning the ontogenetic stage) was recorded in the trophic spectrum of some other lizard species (BEST & GENNARO, 1985; MURRAY & SCHRAMM, 1987; ORTEGA-RUBIO et al., 1995). Anyway, the fact that, in other areas, antlions were not mentioned in the food of this species (MOLLOV et al., 2012; MOLLOV & BOYADZHIEV, 2021) can be a consequence of the fact that *P. tauricus* is not linked to sandy soil in other points of its distribution range (BÖHME et al., 2009), not even in Romania (FUHN & VANCEA, 1961). Otherwise, due to its similar size to *Z. vivipara* (FUHN & VANCEA, 1961), this species' feeding also contains small-sized prey, and spiders are more numerous than in the case of the other two species of the Lacerta genus. Furthermore, *P. tauricus* also captured flying prey, such as butterflies and many flies, as its quick movements permit access to such preys. Even if on the sand in summer and autumn numerous Orthopterans are available, these were rarely consumed, probably due to their large size, although in the trophic spectrum of European green lizards in southern Romania, these made up the largest amount (MAIER et al., 2020). In the case of *P. tauricus,* too, Orthopterans had the highest percentage in some populations from Bulgaria, but there the number of preys/individual was lower (MOLLOV et al., 2012). In north-western Romania, lizards probably consume a larger number of preys to compensate for their small dimensions.

REFERENCES

ANGELICI F. M., LUISELLI L., RUGIERO L. 1997. Food habits of the green lizard, *Lacerta bilineata*, in central Italy and a reliability test of faecal pellet analysis. *Italian Journal of Zoology*. Taylor & Francis. **64**: 267-272.

ARDELEAN G. & KARÁCSONYI C. 2002. *Flora şi Fauna Văii Ierului (înainte şi după asanare).* Edit. Bion, Satu-Mare. 675 pp.

AVERY R. A. 1962. Notes on the ecology of *Lacerta vivipara* L. *British Journal of Herpetology*. Cambridge University Press. **3**: 36-38.

AVERY R. A. 1966. Food and feeding habits of the common lizard (*Lacerta vivipara*) in the west of England. *Journal of Zoology*. Wiley & Sons. **149**(2): 115-121.

BEST T. L. & GENNARO A. L. 1985. Food habits of the western whiptail lizard (*Cnemidophorus tigris*) in southeastern New Mexico. *Great Basin Naturalist*. Bringham Young University Press. **45**(3): 527-534.

BOGDAN H. V., COVACIU-MARCOV S.-D., GACEU O., CICORT-LUCACIU A.-S., FERENȚI S., SAS-KOVÁCS I. 2013. How do we share food? Feeding of four amphibian species from an aquatic habitat in south-western Romania. *Animal Biodiversity and Conservation*. Museu de Ciencies Naturals de Barcelona. **36**(1): 89-99.

BÖHME W., LYMBERAKIS P., AJTIC R., TOK V., UGURTAS I. H., SEVINÇ M., CROCHET P.-A., HAXHIU I., KRECSÁK L., STERIJOVSKI B., LYMBERAKIS, CRNOBRNJA ISAILOVIC J., PODLOUCKY, COGALNICEANU D., AVCI A. 2009. *Podarcis tauricus*. The IUCN Red List of threatened species 2009: eT61554A12515695.

CASTILLA A. M., BAUWENS D., LLORENTE G. A. 1991. Diet Composition of the Lizard *Lacerta lepida* in central Spain. *Journal of Herpetology*. Society for the Study of Amphibians and Reptiles. **25**(1): 30-36.

CICORT-LUCACIU A. Ș., CUPȘA D., ILIEȘ D., ILIEȘ A., BAIAȘ Ș., SAS I. 2011. Feeding of two Amphibian species (*Bombina variegata* and *Pelophylax ridibundus*) from artificial habitats from Pădurea Craiului Mountains (Romania). *North-Western Journal of Zoology*. University of Oradea Publishing House. **7**(2): 297-303.

CICORT-LUCACIU A.-Ș., PELLE C., BORMA I. T. 2013. Note on the food composition of a *Pelophylax ridibundus* population from the Dubova locality region, south-western Romania. *Biharean Biologist*. University of Oradea Publishing House. **7**(1): 33-36.

CROVETTO F. & SALVIDIO S. 2013. Feeding habits of the sand lizard, *Lacerta agilis*, from north-western Italian Alps. *Folia Zoologica*. Academy of Sciences of the Czech Republic. **62**(4): 264-268.

COGĂLNICEANU D., ROZYLOWICZ L., SZÉKELY P., SAMOILĂ C., STĂNESCU F., TUDOR M., SZÉKELY D., IOSIF R. 2013. Diversity and distribution of reptiles in Romania. *ZooKeys*. Pensoft Publishers. **341**: 49-76.

COVACIU-MARCOV S.-D., SAS I., CUPȘA D., ROIS R., BOGDAN H. 2005. The trophic spectrum of a population of *Bufo viridis* (Amphibia) from the campus of the University of Oradea, Romania. *Biota*. DPPVN (Society of bird research and nature protection). **5**: 5-12.

COVACIU-MARCOV S.-D., CICORT-LUCACIU A.-Ș., FERENȚI S., DAVID A. 2008. The distribution of lowland *Zootoca vivipara* populations in north-western Romania. *North-Western Journal of Zoology*. University of Oradea Publishing House. **4**(1): 72-78.

COVACIU-MARCOV S.-D., SAS I., CICORT-LUCACIU A.-Ș., KOVACS E. H., PINTEA C. 2009. Herpetofauna of the Natural Reserves from Carei Plain: zoogeographical significance, ecology, statute and conservation. *Carpathian Journal of Earth and Environmental Sciences*. North University of Baia Mare. **4**(1): 69-80.

COVACIU-MARCOV S.-D., CICORT-LUCACIU A.-Ș., MITREA I., SAS I., CAUȘ A. V., CUPȘA D. 2010. Feeding of three syntopic newt species (*Triturus cristatus*, *Mesotriton alpestris* and *Lissotriton vulgaris*) from western Romania. *North-Western Journal of Zoology*. University of Oradea Publishing House. **6**(1): 95-108.

COVACIU-MARCOV S.-D., FERENȚI S., CICORT-LUCACIU A.-Ș., SAS-KOVACS I. 2012. Terrestrial isopods in the diet of two amphibian species (*Epidalea viridis* and *Pelobates syriacus*) from Dobruja, Romania. *Entomologica romanica*. "Babeș-Bolyai" University Cluj Napoca, Romanian Lepidopterological Society. **17**: 5-11.

CUPȘA D., TELCEAN I. C., CICORT-LUCACIU A.-Ș., SAS-KOVÁCS I., FERENȚI S., COVACIU-MARCOV S.-D. 2020. Newts and fish in the remnants of former wetlands from north-western Romania in front of the same enemy. *Oltenia. Studii și Comunicări Științele Naturii*. Muzeul Olteniei Craiova. **36**(1): 100-108.

ÇIÇEK K. & GÖÇMEN B. 2013. Food composition of Ocellated Skink, *Chalcides ocellatus* (Forskal, 1775) (Squamata: Scincidae), from Cyprus island. *Acta Herpetologica*. Societas Herpetologica Italica. **8**(2): 167-170.

ÇIÇEK K., TOK C.V., HAYRETDAĞ S., AYAZ D. 2014. Data on the food composition of European glass lizard, *Pseudopus apodus* (Pallas, 1775) (Squamata: Anguidae) from Çanakkale (Western Anatolia, Turkey). *Acta Zoologica Bulgarica*. Bulgarian Academy of Sciences. **66**(3): 433-436.

FERENȚI S. & COVACIU-MARCOV S.-D. 2012. Comparison of terrestrial isopod (Isopoda, Oniscidea) assemblages from two types of forests from north-western Romania. *Ecologia Balkanica*. University of Plovdiv "Paisii Hilendarski". **4**(2): 61-67.

FERENȚI S. & DIMANCEA N. 2012. Some data on the terrestrial isopods (Isopoda, Oniscidea) from a wet meadow near an artificial canal in north-western Romania. *Ecologia Balkanica*. University of Plovdiv "Paisii Hilendarski". **4**(1): 117-120.

FERENȚI S. & DIMANCEA N. 2013. Some data upon the terrestrial isopod assemblage from a north-western Romanian wetland. *Oltenia. Studii și Comunicări Științele Naturii.* Muzeul Olteniei Craiova. **29**(1): 302-305.

FERENȚI S., CUPȘA D., COVACIU-MARCOV S.-D. 2012a. Terrestrial isopod assemblages from four habitats from Crasna Hills, north-western Romania. *Oltenia. Studii și Comunicări Științele Naturii*. Muzeul Olteniei Craiova. **28**(1): 45-48.

FERENȚI S., SAS-KOVÁCS É.-H., CUPSA D., IANC R. M. 2012b. Some data on the terrestrial isopod assemblages from Livada Forest, north-western Romania. *Entomologica romanica*. "Babeș-Bolyai" University Cluj Napoca, Romanian Lepidopterological Society. **17**: 13-19.

FISCHER D., BABICKÁ K., FISCHEROVÁ J., LERCH Z., MIKÁTOVÁ B., REOTER A., REHÁK I. 2019. Discovery of the *Podarcis tauricus* population in the Czech Republic. *Acta Societatis Zoologicae Bohemicae*. Czech Zoological Society. **83**: 239-254.

FUHN I. & VANCEA Ş. 1961. "Fauna R.P.R.", vol. XIV, Fascicola II, Reptilia. Edit. Academiei R.P.R. București. 352 pp.

GACHE C. 2014. Status of the bird fauna from "Carei Plain" natural protected area, north-western Romania, in 2011. *North-Western Journal of Zoology*. University of Oradea Publishing House. **10** (Supplement 1): S125-S134.

GLANDT D. 1976. Ökologische beobachtungen and niederrheinischen *Lacerta*-populationen, *Lacerta agilis* und *Lacerta vivipara*. *Salamandra*. Deutsche Gesellschaft für Herpetologie und Terrarienkunde. **12**(3): 127-139.

HAMMER Ø., HARPER D. A. T., RYAN P. D. 2001. PAST: Paleontological statistics software package for education and data analysis. *Palaeontologia Electronica*. Coquina Press. **4**(1): 9.

HARDY L. M. & CRNKOVIC A. C. 2006. Diet of amphibians and reptiles from the Engare Ondare river region of central Kenya, during the dry season. *African Journal of Herpetology*. Taylor & Francis. **55**(2): 143-159.

ILE G. A., MAIER A.-R.-M., CADAR A.-M., COVACIU-MARCOV S.-D., FERENȚI S. 2020. Dead snakes and their stories: morphological anomalies, asymmetries and scars of road killed *Dolichophis caspius* (Serpentes, Colubridae) from Romania. *Herpetozoa*. Austrian Herpetological Society. **33**: 77-85.

KOPECKÝ O., VOJAR J., ŠUSTA F., REHÁK I. 2012. Composition and scaling of male and female Alpine newt (*Mesotriton alpestris*) prey, with related site and seasonal effects. *Annales Zoologici Fennici*. Finnish Zoological and Botanical Publishing Board. **49**: 231-239.

LEU M. & PETROVAN S. O. 2022. Eastern green lizard *Lacerta viridis* predation on adult wall lizard *Podarcis muralis* - another reason for tail lose in small lacertids? *Herpetological Bulletin*. British Herpetological Society. **162**: 17-18.

LŐW P. & TÖRÖK J. 1998. Prey size selection and food habits of water frogs and moor frogs from Kis-Balaton, Hungary. *Herpetozoa*. Austrian Herpetological Society. **11**(1/2): 71-78.

MAIA-CARNEIRO T., KIEFER M. C., VAN SLUYS M., ROCHA C. F. D. 2013. Feeding habits, microhabitat use, and daily activity period of *Rhinella ornata* (Anura, Bufonidae) from three Atlantic rainforest remnants in southeastern Brazil. *North-Western Journal of Zoology*. University of Oradea Publishing House. **9**(1): 157-165.

MAIER A.-R.-M., CADAR A.-M., COVACIU-MARCOV S.-D. 2020. Last meal: food composition of road-killed *Lacerta viridis* (Reptilia: Lacertidae) from Romania. *Studia Universitatis Babeş-Bolyai, Biologia*. "Babeș-Bolyai" University. **65**(1): 49-60.

MAIER A.-R.-M., FERENȚI S., DUMBRAVĂ A.-R., CADAR A.-M. 2022. A late autumn feeding: diet of *Salamandra salamandra* (Linnaeus, 1758) (Amphibia: Salamandridae) in October and November in the Iron Gates Natural Park, Romania. *Acta Zoologica Bulgarica*. Bulgarian Academy of Sciences. **74**(2): 195-201.

MANSELL M. W. 1999. Evolution and success of antlions (Neuropterida: Neuroptera: Myrmeleontidae). *Stapfia*. Biocenter Linz. **60**: 49-58.

MOLLOV I. & PETROVA S. 2013. A contribution to the knowledge of the trophic spectrum of three lacertid lizards from Bulgaria. *Journal of BioScience and Biotechnology*. Plovdiv University Press, Bulgaria. **2**(1): 57-62.

MOLLOV I. & BOYADZHIEV P. 2021. Another contribution to the knowledge of the trophic spectrum of few lacertid lizards (Reptilia, Squamata, Lacertidae) from southern Bulgaria. *ZooNotes*. Plovdiv University Press "Paisii Hilendarski" **190**: 1-4.

MOLLOV I., BOYADZHIEV P., DONEV A. 2012. Trophic niche breadth and niche overlap between two lacertid lizards (Reptilia: Lacertidae) from South Bulgaria. *Acta Zoologica Bulgarica*. Bulgarian Academy of Sciences. Suppl. **4**: 133-140.

MONTECHIARO L., KAEFER I. L., QUADROS F. C., CECHIN S. 2011. Feeding habits and reproductive biology of the glass lizard *Ophiodes* cf. *striatus* from subtropical Brazil. *North-Western Journal of Zoology*. University of Oradea Publishing House. **7**(1): 63-71.

MURRAY G.W. & SCHRAMM D. 1987. A comparative study of the wedge-snouted sand lizard, *Meroles cuneirostris* (Strauch), and the sand diving lizard, *Aporosaura achietae* (Bocage), (Lacertidae), in the Namib Desert. *Madoqua*. Namibian Ministry of Environment and Tourism. **15**(1): 55-61.

ORTEGA-RUBIO A., GONZÁLES-ROMERO A., BARBAULT R. 1995. Food analysis and resource partitioning in a lizard guild of the Sonoran Desert, Mexico. *Journal of Arid Environments*. Elsevier. **29**: 367-382.

PILORGE T. 1982. Régime alimentaire de *Lacerta vivipara* et *Rana temporaria* dans deux populations sympatriques du Puy-de-Dôme. *Amphibia-Reptilia*. Societas Europaea Herpetologica **3**: 27-31.

POP E. 1960. Mlaştinile de turbă din Republica Populară Romînă. Edit. Academiei Republici Populare Romîne, București. 514 pp.

RADU V. G. & RADU V. V. 1967. Zoologia nevertebratelor, vol. 2. Edit. Didactică și Pedagogică, București. 707 pp.

ROȘCA I., GHERGHEL I., STRUGARIU A., ZAMFIRESCU Ș. R. 2013. Feeding ecology of two newt species (*Triturus cristatus* and *Lissotriton vulgaris*) during the reproduction season. *Knowledge and Management of Aquatic Ecosystems*. EDP Sciences. **408**: 05.

SAGONAS K., PAFILIS P., LYMBERAKIS P., VALAKOS E. D. 2015. Trends and patterns in the feeding ecology of the widespread Balkan green lizard *Lacerta trilineata* (Squamata: Lacertidae) in insular and continental Greece. *North-Western Journal of Zoology*. University of Oradea Publishing House. **11**(1): 117-126.

SAGONAS K., VALAKOS E.D., LYMBERAKIS P., PAFILIS P. 2018. Traits of reproduction and feeding of the Green Lizard, *Lacerta viridis* (Laurenti, 1768), at the southern edge of its distribution. *Herpetozoa*. Pensoft Publishers. **30** (3/4): 115-129.

SAS I., COVACIU-MARCOV S.-D., STRUGARIU A., DAVID A., ILEA C. 2009. Food Habit of *Rana* (*Phelophylax*) *kl. esculenta* females in a new recorded E-System population from a forested habitat in north-western Romania. *Turkish Journal of Zoology*. Scientific and Technological Research Council of Turkey. **33**: 1-5.

SAS-KOVÁCS É. H., URÁK I., CUPȘA D., SAS-KOVÁCS I., FERENȚI S., RÁKOSY L. 2015. Wolf spider (Araneae: Lycosidae) assemblages of a deciduous forest in north-western Romania. *Entomologia Generalis*. Schweizerbart Science Publishers. **35**(3): 199-211.

SHINE R. 1988. Food habits and reproductive biology of small Australian snakes of the genera *Unechis* and *Suta* (Elapidae). *Journal of Herpetology*. Society for the Study of Amphibians and Reptiles. **22**(3): 307-315.

SÎRBU D. F. 1977. Contribuții la cunoașterea hranei la șopârla de munte (*Lacerta vivipara*) din Munții Apuseni. *Studia Universitatis Babeș-Bolyai, Biologia*. Babeș-Bolyai University. **22**(2): 77-80.

SÎRBU D.F. 1979. Contribuții la cunoașterea hranei la șopârla de munte (*Lacerta vivipara*) din Munții Apuseni (II). *Studia Universitatis Babeș-Bolyai, Biologia*. Babeș-Bolyai University. **24**(2): 15-18.

SEVIANU E., PETRIȘOR M., MALOȘ C.-V., HARTEL T. 2022. Habitat preferences of the European green lizard *Lacerta viridis* (Laurenti 1768) in a protected area, Romania. *Studia Universitatis Babeș-Bolyai, Biologia*. Babeș-Bolyai University. **67**(1): 165-176.

TOMESCU N., BOGDAN H., PETER V. I., COVACIU-MARCOV S.-D., SAS I. 2008. Terrestrial isopods from the western and north-western Romania. *Studia Universitatis Babes-Bolyai, Biologia*. Babeș-Bolyai University. **53**(2): 3-15.

UJVÁRI I. 1972. *Geografia apelor României*. Edit. Științifică. București. 272 pp.

VACHEVA E. & NAUMOV B. 2020. Diet of the viviparous lizard *Zootoca vivipara* (Lichtenstein, 1823) (Reptilia: Lacertidae) from its southern range. *North-Western Journal of Zoology*. University of Oradea Publishing House. **16**(2): 178-190.

VACHEVA E. & NAUMOV B. 2022. A contribution to the knowledge of the diet and food preferences of *Darevskia praticola* (Reptilia: Lacertidae). *Acta Herpetologica*. Societas Herpetologica Italica. **17**(1): 29-36.

VERWAIJEN D., VAN DAMME R., HERREL A. 2002. Relationships between head size, bite force, prey handling efficiency and diet in two sympatric lacertid lizards. *Functional Ecology*. Wiley-Blackwell. **16**: 842-850.

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