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Microhabitat use, seasonal activity and diet of the snake-eyed skink (*Ablepharus kitaibelii fitzingeri*) in comparison with sympatric lacertids in Hungary

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Abstract: Microhabitat selection and seasonal activity of the snake-eyed skink, *Ablephaus kitaibelii fitzingeri*, are compared to the two lacertid lizards (*Lacerta viridis* and *Podarcis muralis*) that co-occur in many of its habitats. The food composition of *A. k. fitzingeri* is also described. Significant differences in microhabitat selection and seasonal activity among the three species were found. The snake-eyed skink was associated with open grasslands, and with a low level of scrub, bare soil and rock cover. The microhabitat preference of *L. viridis* was quite similar to that of the skink, but with a higher preference for scrub. *P. muralis* occurred in places with greater rock and bare soil cover, and more scrub than *A. k. fitzingeri*. Activity of the snake-eyed skink decreased dramatically in summer, probably because of the reduced thermal inertia originating from the extremely small size of this species, but its seasonal activity overlapped with those of the lacertids. Stomach content analysis of the snake-eyed skink suggests that it is a generalist predator of small, mainly flightless arthropod prey. Competition with juvenile lacertids and predation by adult *L. viridis* are conceivable for the snake-eyed skink.

Key words: *Ablepharus kitaibelii fitzingeri*; diet composition; *Lacerta viridis*; microhabitat use; *Podarcis muralis*; seasonal activity

Introduction

The snake-eyed skink, *Ablepharus kitaibelii* Bibron et Bory, 1833 is the only representative of the genus in Europe and also the northernmost European representative of the family Scincidae. Despite the unique status of the snake-eyed skink in the European herpetofauna, almost all aspects of its biology have remained unstudied (Gasc et al. 1997; Pasuljevič 1965, 1976), probably because of its secretive habits. *Ablepharus kitaibelii fitzingeri* Mertens, 1952, which occupies the northern range of the species' distribution area, occurs mainly in Hungary, with sporadic records in southern Slovakia and northern Serbia (Mertens 1952; Fuhn 1969; Gruber 1981; Ljubisavljevic et al. 2002).

In Europe, the species is listed in the Bern Convention (Council of Europe 1994), Appendix 2 and in the European Union Habitat Directive (European Commission 1992), Annex IV, as a species in need of strict protection. *A. k. fitzingeri* is strictly protected in Hungary and is listed in the Hungarian Red Data Book as a potentially endangered taxon (Rakonczay 1989). However, most previous studies have dealt only with its morphology and distribution (e.g., Fitzinger 1829; Lendl 1899; Fejérváry 1912, 1917, 1925; Bolkay 1914; Méhely 1918; Fejérváry-Lángh 1943; Szunyoghy 1954; Dely 1978; Solti & Varga 1988). A summary of the current distribution and possible threatening factors of *A. k. fitzingeri* in Hungary was published recently (Herczeg et al. 2004). Its general ecology is virtually unknown except from some anecdotal observations, and even its current demographic status is based on inadequate census data, and most local populations are subject to continued human disturbance (Korsós 1994; Herczeg & Korsós 2003). Before any sound conservation plan can be developed, a basic knowledge of its general ecology is required.

Community structure and resource utilisation / partition patterns of lizards have been an attractive topic for ecologists in the last half century (e.g., Schoener 1968; Pianka 1973; Vitt et al. 1981, 2000). From this work it was suggested that space, time and diet are perhaps the most important limiting factors where segregation in lizard assemblages could be detected (e.g., Schoener 1968; Pianka 1973; Toft 1985; Vrcibradic & Rocha 1996). The tools developed in these studies are widely used to answer conservation questions (e.g., Sartorius et al. 1999; Vega et al. 2000) or for describing the ecological requirements of endangered species (e.g., Martín & Salvador 1995). In this paper, we present the first report of microhabitat use, seasonal activity and diet of the snake-eyed skink. With respect to microhabitat use and seasonal activity, we compared *A. k. fitzingeri* with the sympatric *Lacerta*

viridis Laurenti, 1768 and *Podarcis muralis* Laurenti, 1768, the lacertid lizards that co-occur with the snake-eyed skink at most of its Hungarian sites (Herczeg & Korsós 2003). Our goal was to provide some ecological data on the snake-eyed skink, which conservationists can use for the conservation management of this reptile endemism of the Carpathian Basin.

Material and methods

Study organisms and sampling

The northernmost subspecies (*A. k. fitzingeri*) of the snake-eyed skink (*A. kitaibelii*) is one of the smallest lizards in Europe, with a snout to vent length (SVL) of 20–55 mm (juveniles ca. 22–30 mm) and body mass (BM) of 0.15–1.5 g. In Hungary, it occurs in different habitats with respect to substrate: sandstone, limestone, dolomite, andesite, gabbro, basalt, or even pure sand (Herczeg et al. 2004; for more details of the species see Gruber 1981). The common wall lizard (*P. muralis*) is a rock-dwelling, insectivorous heliotherm species and has SVL of 25–65 mm (juveniles ca. 25–35 mm) and BM of 0.7–6.5 g, and is widespread in Europe (for details see Gruschwitz & Böhme 1986). The green lizard (*L. viridis*) is one of the largest lizards in Europe with SVL of 30–120 mm (juveniles ca. 30–45 mm) and BM of 0.9–25 g. It is a ground-dwelling, insectivorous heliotherm lizard and is widespread in Europe (for details see Nettmann & Rykena 1984).

Fieldwork was carried out in the Sas Hill Nature Reserve, a dolomite hill (maximum elevation 259 m a.s.l.) within the area of Budapest (47°30′ N; 19°51′ E). The habitat offered various microhabitat types, such as closed or opened dolomite grasslands, solitary or aggregated scrub, forest patches and rocky outcrops.

We sampled lizards over six, five and six days in spring, summer and autumn, respectively, from 12 March to 12 November in 2002 to investigate microhabitat use and seasonal activity. Sampling days were once every second week within each season and we chose mostly clear, sunny days. Sampling was always by the first author from 07.00 to 19.00 on each day. GH moved slowly through the area and if a lizard was detected, species and microhabitat variables (cover of herbaceous plants, cover of arboreal/mainly scrub/ plants, rock cover and percentage of bare soil were estimated to the nearest 5%; height of herbaceous plants and arboreal plants were measured (to the nearest 5 cm) and recorded within 2 m of the location where the lizard was first seen. A constant effort was made to sample each habitat type. Altogether 255 lizards (46 *A. k. fitzingeri*, 113 *L. viridis*, and 96 *P. muralis*) were recorded. Some additional individuals were observed without full data recording. We used the latter data only in the seasonal activity analyses. We did not mark (or capture) the lizards, but, due to the large study area and the high lizard density, we assumed that the rate of repeated observations of the same individuals is low.

We used the standard stomach-flushing methods (Legler & Sullivan 1979; James 1990) using tubes with diameter ranging from 0.7 to 1.2 mm (with respect to the size of the given lizard specimen) for the diet analysis. Forty-one individuals of *A. k. fitzingeri* were stomach-flushed, 20 in spring, and 21 in autumn. Lizards for stomach-flushing were collected on days other than those used for recording microhabitat use and activity data. None of the sampled individuals suffered injuries or died because of the sampling. We made an effort to sample the diet of the lacertids also, but the sample sizes were too small for biologically meaningful interpretations. Taxonomic diet composition was summarized as the proportion of prey items from a given taxon in the total number of prey items (n%) and the proportion of lizard individuals eating a prey taxon (F), after James (1991) and Maragou et al. (1996).

Statistical analyses

We used principal components analysis to reduce the six original environmental variables to a smaller number of orthogonal principal components (PCs). We used data only from spring and autumn as *A. k. fitzingeri* was almost completely absent in summer ($n = 2$). Three PCs were extracted from the six original variables according to Kaiser's criteria. To gather biologically interpretable PCs we rotated the initial factor solutions by the Varimax procedure. We tested for differences in the PC scores between species using Analysis of Variance (ANOVA) followed by the LSD test. Due to the low number of observed *A. k. fitzingeri* individuals, we did not test for seasonal differences. We compared the seasonal activities of the species using χ^2 tests.

We calculated Shannon diversity indices and compared them with Hutcheson *t*-tests (Hutcheson 1970). To compare the diet composition between the spring and autumn samples, we calculated Proportional Similarity indices. To explore the relationship between F and n%, we used the Spearman rank correlation test.

Because our purpose was to study interspecific differences, we randomly assigned individuals between sex, age and size categories. All statistics were computed using STATISTICA 7.0 for WINDOWS (StatSoft Inc., Tulsa, Oklahoma, 1994) software.

Results

The three PCs together accounted for 75% of the total variance (Table 1). According to Norman & Streiner (2000), the critical value for the minimum acceptable factor loading was 0.362 in our case. The first PC was negatively correlated with cover and height of arboreal plants and positively with the cover of herbaceous plants (Table 1). Thus PC1 describes a gradient from grasslands to scrub and forest patches. The second PC was positively correlated with the cover and height of herbaceous plants and negatively with rock cover (Table 1), likewise describing a gradient from grassy areas to rocky outcrops. The third PC was positively correlated with the cover of bare soil and negatively with the cover of herbaceous plants (Table 1), i.e., it represents a gradient from open, patchy grassland to thick, closed grassland.

The ANOVAs on the PC scores revealed significant effects of the factor lizard species for both PCs (Fig. 1; PC1: $F_{2,202} = 3.84$; $P = 0.02$; PC2: $F_{2,202} = 32.78$; $P < 0.001$; PC3: $F_{2,202} = 3.38$; $P = 0.04$). In PC1 *A. k. fitzingeri* differed from both lacertids (LSD tests; all $P < 0.04$) while the latter did not differ from each other (LSD test: $P = 0.51$). In PC2 and PC3 *P. muralis* differed from *A. k. fitzingeri* and *L. viridis* (LSD tests: all $P < 0.03$), while the latter did not differ from each other (LSD tests: all $P > 0.58$). The seasonal activities differed among the species in all pairwise comparisons, even after a Bonferroni adjustment ($\chi^2_{16} > 68.03$, $P <$

Table 1. Correlations of microhabitat variables with the first three PC scores after Varimax rotation for *A. k. fitzingeri*, *L. viridis* and *P. muralis* using data from spring and autumn.

	PC1	PC2	PC3
Ground cover			
Herbaceous plants	0.481	0.600	−0.625
Arboreal plants	−0.886	−0.112	−0.039
Bare soil	0.087	0.196	0.942
Rock cover	0.030	−0.914	0.057
Height			
Herbaceous plants	−0.037	0.482	0.215
Arboreal plants	−0.799	0.151	0.036
Eigenvalue	1.667	1.502	1.332
Cumulative % of variance	0.278	0.528	0.750

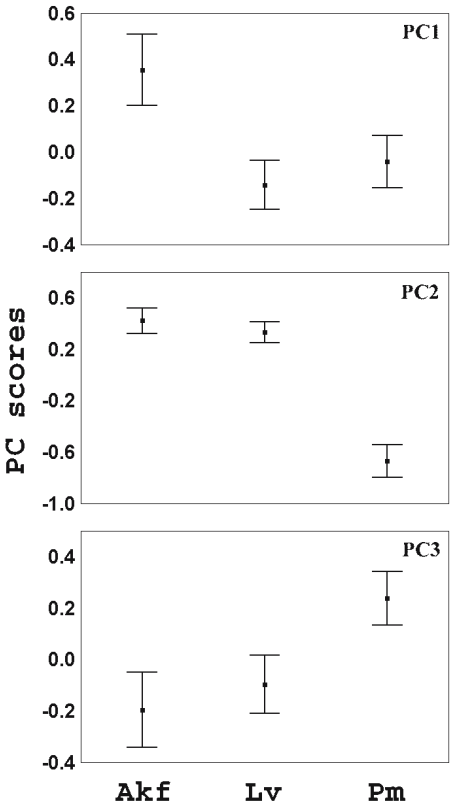

Fig. 1. Microhabitat selection of *A. k. fitzingeri* (Akf), *L. viridis* (Lv) and *P. muralis* (Pm). Mean PC scores ± SE provided. For the description of the PCs see text and Table 1.

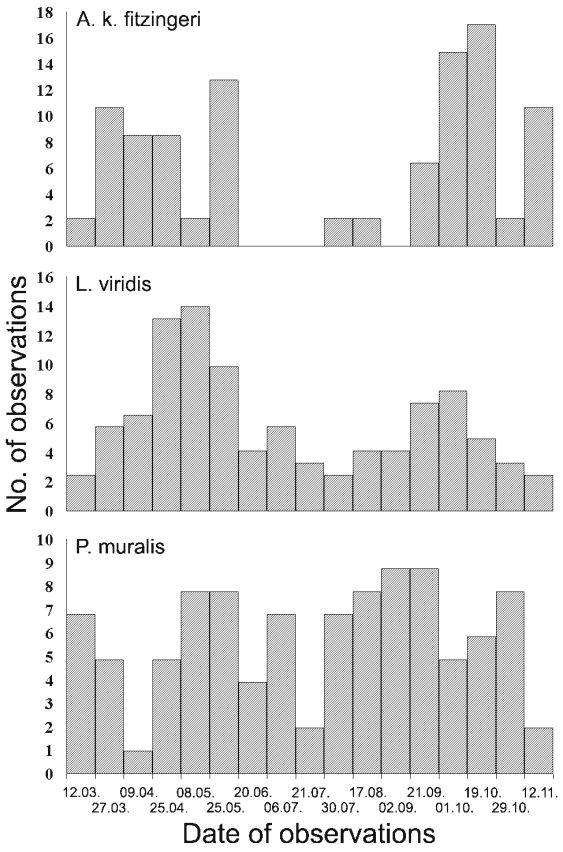

Fig. 2. Seasonal activity of *A. k. fitzingeri*, *L. viridis* and *P. muralis*.

0.001; Fig. 2). Prey diversity of *A. k. fitzingeri* did not differ between spring and autumn (Hutcheson *t*-test: $P > 0.9$). We found a high level of overlap between the diet composition of *A. k. fitzingeri* in spring and autumn (Proportional Similarity index: 0.67). F and n% were strongly correlated ($r_S = 0.95$, $n = 13$, $P < 0.001$). The most frequent prey taxa (in order of n%) were Homoptera, Araneae, Formicidae and Coleoptera in the skink's diet (Table 2).

Discussion

We found that *A. k. fitzingeri* occurred in grasslands with a low proportion of bushes and trees, bare soil or rocks. When compared to the skink, *P. muralis* preferred less closed grasslands with a higher proportion of scrub, and was obviously associated with the rocky outcrops, while *L. viridis* occupied similar grasslands to the skink but with a higher proportion of bushes and trees. We note that our results are based on microhabitat variables recorded in an area within 2 m of the observed lizards, thus to an extent, the species co-occur. The phylogenentic history of the species studied adds an important component to the understanding of lizard communities (e.g., Vitt et al. 2003); further, lizard morphology and habitat-use are related as a result of adaptation (Vanhooydonck & Van Damme 1999; Vanhooydonck et al. 2000). *A. k. fitzingeri* is a typical skink with its slim, cylindrical body and reduced legs. It avoids rocky places, as its locomotion is less effective on non-horizontal rock surfaces due to its morphology, and it also needs loose soil for digging. *P. muralis* is morphologically (and evolutionarily) adapted to a rock-dwelling life, thus its association with rocky microhabitats with low scrubs is not surprising. Microhabitat use of *L. viridis* is harder to interpret. It appears to move well in both microhabitat types, with adult individuals moving more than 5–10 m during normal escaping and foraging events in a few seconds. However, its association with scrub can be derived from another behavioural characteristic. We observed considerable dif-

Table 2. Stomach contents of *A. k. fitzingeri*. Columns do not necessarily denote equivalent taxonomic levels. Number of prey items, proportion of the total number of prey items (n%), and the proportion of lizard individuals eating the prey taxon (F) are shown. Marked (bold) prey taxa represent altogether more than 75% of the total number of prey items of *A. k. fitzingeri* in its whole activity season. (L) denotes larvae.

Season			Spring			Autumn			Total		
Shannon diversity			2.01			2.06			2.16		
Sample size			20			21			41		
Prey			N	n%	F	N	n%	F	N	n%	F
Insecta	Homoptera	Aphidina	15	21	20	3	4.8	9.5	18	**13.3**	14.6
		Others	17	23.6	45	11	17.5	33.3	28	**20.7**	39
	Heteroptera		1	1.4	5	3	4.8	14.3	4	3	9.8
	Coleoptera		8	11.1	15	8	12.7	28.6	16	**11.8**	21.9
	Coleoptera (L)		3	4.2	15	4	6.3	19	7	5.2	17.1
	Hymenoptera	Formicidae	2	2.8	10	17	27	28.6	19	**14.1**	19.5
		Others	1	1.4	5	–	–	–	1	0.7	2.4
	Lepidoptera		1	1.4	5	–	–	–	1	0.7	2.4
	Lepidoptera (L)		5	6.9	20	3	4.8	14.3	8	5.9	14.1
	Diptera		2	2.8	10	2	3.2	9.6	4	3	9.8
	Diptera (L)		–	–	–	1	1.6	4.8	1	0.7	2.4
Arachnida	Araneae		14	19.4	60	11	17.5	47.6	25	**18.5**	58.5
	Pseudoscorpiones		3	4.2	10	–	–	–	3	2.2	4.9
Total			72	100	–	63	100	–	135	100	

ferences in the escape tactics between the skink and the lacertids (Herczeg & Korsós 2003), and these differences might influence their microhabitat use. The lacertids flee without cover to the nearest refuge, which is usually a rock crevice for *P. muralis* and scrub for *L. viridis* (we found that *L. viridis* often climbs to scrub when chased), thus the latter should prefer grassland with solitary scrub or the grassland – scrubland edges (see also Korsós 1984). *A. k. fitzingeri* needs no special refuge, as it usually responds to predators (e.g., human observer) by immediately hiding within 1 m under grass and leaf litter and probably digging itself in, hence it can occur with no regard to scrub. These results suggest that a common habitat-depressing factor, namely the fragmentation of grasslands by spreading natural or invasive scrub species (Herczeg et al. 2004), would favour *L. viridis*.

A. k. fitzingeri was found to be a generalist predator from the high diversity of its prey and the correlated F and n% values. Prey taxa eaten by *A. k. fitzingeri* were also important components of the diet of different lacertids as found in previous studies (e.g., Avery 1966; Koponen & Hietakangas 1972; Valakos et al. 1997). However, the great importance of the taxon Homoptera for the skink is unusual. In contrast, important taxa in the diet of different lacertid species such as Gastropoda, Orthoptera and Isopoda (Avery 1966; Koponen & Hietakangas 1972; Diaz & Carrascal 1990; Mellado & Corti 1993; Rugiero 1994; Valakos et al. 1997) were completely absent from the stomach contents of *A. k. fitzingeri*. We assume that, according to the head size – prey size relationship in most generalist lizards (e.g., DeMarco et al. 1985; Vitt 2000), juvenile lacertids, irrespective of species, could compete for food with *A. k. fitzingeri*. In addition, in the case of adult *L. viridis*, predation pressure on the skink cannot be disregarded, as in the stomach contents of eight adult *L. viridis*, we found remnants of two adult *A. k. fitzingeri*.

Seasonal activity patterns were different among the three species, but the activity of *A. k. fitzingeri* overlapped to a large extent with the two lacertid species. The minimal activity of *A. k. fitzingeri* in summer, the hottest and driest season, suggests an increased danger of overheating for this extremely small-bodied species, due to its small thermal inertia (Herczeg et al. 2007). The bimodality in the activity of *L. viridis* is a result of the bimodal activity of the juvenile (and thus similarly constrained) members of the species (Herczeg et al. 2007).

In summary, *A. k. fitzingeri* was associated with grasslands and avoided continuous rock surfaces and dense scrub, and dramatically decreased its activity in summer. Our results support the conclusions of our preliminary study (Herczeg & Korsós 2003): namely that, although there are differences in the spatial and temporal distributions of the studied species, the overlaps among them are considerable. *A. k. fitzingeri* was found to be a generalist predator of small, mainly flightless arthropod prey. Juvenile lacertids, and especially *L. viridis* (due to the spatial overlap with *A. k. fitzingeri*), could be its competitors, while adult *L. viridis* individuals were its predators. In the light of our results, we suggest that in the conservation management of *A. k. fitzingeri*, the population interactions within a focal lizard assemblage cannot be disregarded. In anthropogenically-disturbed habitats, the disturbance due to habitat conversion might change the strength of the interpopulation interactions in many ways (Vega et al. 2000; Taylor & Fox 2001) possibly causing declines in populations of this potentially endangered subspecies.

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References

Avery R.A. 1966. Food and feeding habits of the Common lizard (*Lacerta vivipara*) in the west of England. J. Zool. Lond. **149:** 115–121.

Council of Europe 1994. Convention on the Conservation of European Wildlife and Natural Habitats. Appendices to the Convention. Strasbourg, T-PVS (94)2, Bern, 21 pp.

Bolkay S.J. 1914. Über einen neuen Fundort des *Ablepharus pannonicus* Fitz. in Ungarn. Zool. Anz. **43:** 499–500.

Dely O.G. 1978. Hüllők – Reptilia. In: Magyarország Állatvilága, Fauna Hungariae No. 130. Budapest, Akadémiai Kiadó, 120 pp.

DeMarco V.G., Drenner R.W. & Ferguson G.W. 1985. Maximum prey size of an insectivorous lizard, *Sceloporus undulatus garmani*. Copeia **1985:** 1077–1080.

Diaz J.A. & Carrascal L.M. 1990. Prey size and food selection of *Psammodromus algirus* (Lacertidae) in Central Spain. J. Herpetol. **24:** 342–347.

European Commission 1992. Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora. EC, Brussels, Annex IV, 6 pp.

Fejérváry G.J. 1912. Über *Ablepharus pannonicus* Fitz. Zool. Jahrb., Jena **33:** 547–574.

Fejérváry G.J. 1917. Neuere Angaben über die geographische Verbreitung des *Ablepharus pannonicus* Fitz. in Ungarn. Verh. Zool.-Bot. Ges., Wien **67:** 161–167.

Fejérváry G.J. 1925. Hüllők, pp. 131–138. In: Szilády Z. (ed.), Nagy alföldünk állatvilága 1(3), Debrecen, Tisza István Tudományegyetemi Nyomda.

Fejérváry-Lángh A.M. 1943. Beiträge und Berichtigungen zum Reptilien-Teil des ungarischen Faunenkataloges. Fragm. Faun. Hung. **6:** 81–98.

Fitzinger L. 1829. Über die *Ablepharus pannonicus*, eine neue Eidechse aus Ungarn. Verh. Ges. Naturforsch. Freunde, Berlin **1:** 297–302.

Fuhn I.E. 1969. Revision and redefinition of the genus *Ablepharus* Lichtenstein 1823 (Reptilia, Scincidae). Rev. Roum. Biol. Ser. Zool. **14:** 23–41.

Gasc J-P., Cabela A., Crnobrnja-Isailovic J., Dolmen D., Grossenbacher K., Haffner P., Lescure J., Martens H., Martínez Rica J.P., Maurin H., Oliveira M.E., Sofianidou T.S., Veith M. & Zuiderwijk A. (eds) 1997. Atlas of Amphibians and Reptiles in Europe. Societas Europea Herpetologica & Museum National d'Histoire Naturelle (IEGB/SPN), Paris, 469 pp.

Gruber U. 1981. *Ablepharus kitaibelii* (Bibron & Bory 1833) – Johannisechse, pp. 297–302. In: Böhme W. (ed.), Handbuch der Reptilien und Amphibien Europas 1, Akademische Verlagsges., Wiesbaden.

Gruschwitz M. & Böhme W. 1986. *Podarcis muralis* (Laurenti, 1768) – Mauereidechse, pp. 155–208. In: Böhme W. (ed.), Handbuch der Reptilien und Amphibien Europas 2, Akademische Verlagsges., Wiesbaden.

Herczeg G. & Korsós Z. 2003. Az interspecifikus kompetíció hatása a pannongyíkra (*Ablepharus kitaibelii fitzingeri*) egy antropogén hatásoknak kitett élőhelyen [Competition effect on the skink *Ablepharus kitaibelii fitzingeri* among human caused disturbance]. Állatt. Közlem. **88:** 73–54.

Herczeg G., Tóth T., Kovács T., Korsós Z. & Török J. 2004. Distribution of *Ablepharus kitaibelii fitzingeri* Mertens, 1952 (Squamata: Scincidae) in Hungary. Russ. J. Herpetol. **11:** 99–105.

Herczeg G., Török J. & Korsós Z. 2007. Size-dependent heating rates determine the spatial and temporal distribution of small-bodied lizards. Amphibia-Reptilia **28:** 347–356.

Hutcheson K. 1970. A test for comparing diversities based on the Shannon formula. J. Theor. Biol. **29:** 151–154.

James C.D. 1990. A refinement of the stomach-flushing technique for small scincid lizards. Herpetol. Rev. **21:** 87–88.

James C.D. 1991. Temporal variation in diets and trophic partitioning by coexisting lizards (*Ctenotus*: Scincidae) in central Australia. Oecologia **85:** 553–561.

Koponen S. & Hietakangas H. 1972. Food of the common lizard (*Lacerta vivipara* Jacquin) on a peat bog in southwestern Finland. Ann. Zool. Fenn. **9:** 191–192.

Korsós Z. 1984. Comparative niche analysis of two sympatric lizard species. Vertebrata Hung. **22:** 5–14.

Korsós Z. 1994. *Ablepharus kitaibelii fitzingeri,* pp. 38–39. In: Threatened amphibians and reptiles of Eastern Europe requiring special conservation measures, A corrected report for the Bern Convention by the Societas Europea Herpetologica, T-PVS (94)3, Council of Europe, Strasbourg.

Legler J.M. & Sullivan L.J. 1979. The application of stomach-flushing to lizards and anurans. Herpetologica **35:** 107–110.

Lendl A. 1899. Hazánk nehány speczialitásáról. Term. Tud. Füzetek, Temesvár **23:** 39–55.

Ljubisavljevic K., Dzukic G. & Kalezic M.L. 2002. Morphological differentation of the Snake-eyed skink *Ablepharus kitaibelii* (Bibron & Bory, 1833), in the north-western part of the species' range: systematic implications. Herpetozoa **14:** 107–121.

Maragou P., Valakos E.D., Giannopoulos Z., Stavropoulou A. & Chondropoulos B. 1996. Spring aspect of feeding ecology in *Podarcis peloponnesiaca* (Bibron & Bory, 1933). Herpetozoa **9:** 105–110.

Martín J. & Salvador A. 1995. Microhabitat selection by the iberian rock lizard *Lacerta monticola*: effects of density and spatial distribution of individuals. Biol. Conserv. **79:** 303–307.

Mellado V.P. & Corti C. 1993. Dietary adaptations and herbivory in lacertid lizards of the genus *Podarcis* from western Mediterranean islands. Bonn. Zool. Beitr. **44:** 193–220.

Mertens R. 1952. Über den Glattechsen-Namen *Ablepharus pannonicus*. Zool. Anz. **149:** 48–50.

Méhely L. 1918. Reptilia et Amphibia, pp. 1–12. In: Fauna Regni Hungariae, 1, Kir. Magyar Term. Tud. Társ., Budapest.

Netmann H.K. & Rykena S. 1984. *Lacerta viridis* (Laurenti 1768) – Smaragdeidechse, pp. 129–180. In: Böhme W. (ed.), Handbuch der Reptilien und Amphibien Europas 2, Akademische Verlagsges., Wiesbaden.

Norman G.R. & Streiner D.L. 2000. Biostatistics. Second Edition. B. C. Decker Inc., Hamilton, 324 pp.

Pasuljevič G. 1965. Ritam dnevne i sezonskeaktivnosti *Ablepharus kitaibelii* [Daily and seasonal activity of *Ablepharus kitaibelii*]. Glasn. Mus. Beograd **20:** 311–314.

Pasuljevič G. 1976. Characteristics of habitat and factors determining distribution and activity of the species *Ablepharus kitaibelii* (Lacertilia: Scincidae). Acta Biol. Med. Exp. **1–2:** 57–63.

Pianka E.R. 1973. The structure of lizard communities. Annu. Rev. Ecol. Syst. **4:** 53–74.

Rakonczay Z. (ed.) 1989. Vörös könyv. A Magyarországon kipusztult és veszélyeztetett növény- és állatfajok [Red Data Book. The extinct and endangered plant and animal species of Hungary]. Akadémiai Kiadó, Budapest, 360 pp.

Rugiero L. 1994. Food habits of the Ruin Lizard, *Podarcis sicula* (Rafinesque-Schmaltz, 1810), from a coastal dune in Central Italy. Herpetozoa **7:** 71–73.

Sartorius S.S., Vitt L.J. & Colli G.R. 1999. Use of naturally and anthropogenically disturbed habitats in Amazonian rainforest by the teiid lizard *Ameiva ameiva*. Biol. Conserv. **90:** 91–101.

Schoener T.W. 1968. The *Anolis* lizards of Bimini: resource partitioning in a complex fauna. Ecology **49:** 704–726.

Solti B. & Varga A. 1988. Kétéltü és hüllő adatok Magyarországról [Data relating to amphibia and reptilia of Hungary]. Fol. Hist.-Nat. Mus. Matr. **13:** 113–116.

Szunyoghy J. 1954. Az *Ablepharus kitaibelii kitaibelii* Bibron & Bory új lelőhelye Magyarországon [A new occurrence of the

Ablepharus kitaibelii kitaibelii Bibron & Bory in Hungary]. Állatt. Közlem. **44:** 61–62.

Taylor J.E. & Fox B.J. 2001 Disturbance effects from fire and mining produce different lizard communities in eastern Australian forests. Aust. Ecol. **26:** 193–204.

Toft C.A. 1985. Resource partitioning in amphibians and reptiles. Copeia **1985:** 1–21.

Valakos E.D., Adamopoulou C., Maragou P. & Mylonas M. 1997. The food of *Podarcis milensis* and *Podarcis erhardii* in the insular ecosystems of the Aegean, pp. 373–381. In: Böhme W., Bischoff W. & Ziegler T. (eds), Herpetologica Bonnensis, Societas Europea Herpetologica, Bonn.

Vanhooydonck B. & Van Damme R. 1999. Evolutionary relationships between body shape and habitat use in lacertid lizards. Evol. Ecol. Res. **1:** 785–805.

Vanhooydonck B., Van Damme R. & Aerts P. 2000. Ecomorphological correlates of habitat partitioning in Corsican lacertid lizards. Funct. Ecol. **14:** 358–368.

Vega L.E., Bellagamba P.J. & Fitzgerald L.A. 2000. Long-term effects of anthropogenic habitat disturbance on a lizard assemblage inhabiting coastal dunes in Argentina. Can. J. Zool. **78:** 1653–1660.

Vitt L.J. 2000. Ecological consequences of body size in neonatal and small-bodied lizards in the neotropics. Herpetol. Monogr. **14:** 388–400.

Vitt L.J., Van Loben Sels R.C. & Ohmart R.D. 1981. Ecological relationships among arboreal desert lizards. Ecology **62:** 398–410.

Vitt L.J., Sartorius S.S., Avila-Pires T.C.S., Esposito M.C. & Miles D.B. 2000. Niche segregation among sympatric Amazonian teiid lizards. Oecologia **122:** 410–420.

Vitt L.J., Pianka E.R., Cooper Jr., W.E. & Schwenk K. 2003. History and the global ecology of squamate reptiles. Am. Nat. **162:** 44–60.

Vrcibradic D. & Rocha C.F.D. 1996. Ecological differences in tropical sympatric skinks (*Mabuya macrorhyncha* and *Mabuya agilis*) in Southeastern Brasil. J. Herpetol. **30:** 60–67.

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