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Preliminary data on food habits of an Alpine population of Horvath's Rock Lizard *Lacerta horvathi* MÉHELY, 1904
(Squamata: Sauria: Lacertidae)

Erste Angaben zu den Ernährungsgewohnheiten einer alpinen Population der Kroatischen Gebirgseidechse, *Lacerta horvathi* MÉHELY, 1904
(Squamata: Sauria: Lacertidae)

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KURZFASSUNG

Anhand von Kotuntersuchungen an 81 Individuen werden die Nahrungsgewohnheiten einer Population Kroatischer Gebirgseidechsen, *Lacerta horvathi* MÉHELY, 1904, aus dem Wald von Tarvis (Karnische Alpen, Provinz Udine) analysiert. Die Geschlechter unterschieden sich nicht signifikant in ihrer Kopf-Rumpflänge (ANOVA: $P < 0.30$), doch waren die Männchen im Durchschnitt größer als die Weibchen. *Lacerta horvathi* ernährt sich hauptsächlich von Weberknechten und Spinnen, während der Anteil an Insekten niedrig ist. Sowohl die mittlere Anzahl von Beutetieren je Kotballen als auch die Nahrungsnischenbreite sind bei Männchen größer als bei Weibchen und Jungtieren, doch sind die Unterschiede zwischen diesen drei Gruppen statistisch nicht signifikant. Im Vergleich zu einer Reihe anderer Halsbandeidechsen erweist sich *L. horvathi* in viel geringerem Ausmaß als Nahrungsgeneralist. Tatsächlich scheint die Art in ihrer Nahrungswahl stark auf bodenlebende Arthropoden spezialisiert zu sein. Weiters läßt der Futtertiertyp darauf schließen, daß *L. horvathi* - wie bei kleinen felsbewohnenden Eidechsen zu erwarten - ein aktiver Jäger ist.

ABSTRACT

The dietary habits of *Lacerta horvathi* MÉHELY, 1904, from the Tarvisio Forest (Carnic Alps, Province of Udine) were studied using faecal pellet analysis. 81 specimens were analyzed for prey remnants in their faecal pellets. The sexes did not differ significantly in terms of SVL (one-way ANOVA: $P < 0.30$), but males were larger than females. *Lacerta horvathi* fed mainly upon Opiliones and Araneae, while the proportion of insects was quite low. Both mean number of prey items per faecal pellet and food niche breadth was higher in males than in females and juveniles, but the differences between the three classes were not statistically significant. Compared with several other lacertid species, *L. horvathi* seems to be much less a food generalist. In fact, it is strongly specialized in preying upon ground-dwelling arthropods. Furthermore, the prey types eaten suggest that this lizard is an active forager, as expected in small-sized rupicolous lacertids.

KEY WORDS

Sauria, Lacertidae; *Lacerta horvathi*, foraging ecology, alpine environment, Tarvisio Forest, Carnic Alps, Italy

INTRODUCTION

Within the territory of Italy, *Lacerta horvathi* MÉHELY, 1904 is restricted to the easternmost parts of the Alps, including the Forest of Tarvisio in the province of Udine (DARSA 1972; LAPINI & DOLCE 1982). There, this rupicolous species is relatively widespread from 600 to about 2000 m asl (DARSA 1972) but is patchily distributed. In some sites, e.g. in the surroundings of Pontebba, at about 700 m a.s.l., *L. horvathi* lives sympatric with the Common Wall Lizard *Podarcis muralis* (LAURENTI, 1768) (CAPIZZI unpublished observations) which is a possible competitor and shares the same natural predatory risks (e.g. see LUISELLI 1996).

For several Alpine lizards information on trophic ecology is available (e.g. *Anguis fragilis* LINNAEUS, 1758 - see CAPIZZI & al. 1998), while data on Italian *L. horvathi* is still lacking, despite a recent study on food competition with Wall Lizards (RICHARD & LAPINI 1995).

In this paper I present pertinent data on an Alpine population of *L. horvathi*, highlighting on whether this lizard could be considered a food generalist (as most lacertids studied to date, e.g. see MOU 1987; DIAZ 1995; ANGELICI & al. 1997) or a specialist.

MATERIALS AND METHODS

All data given here are based on faecal pellet analyses of lizards collected between June 1993 and September 1996 in the Tarvisio Forest near the village of Valbruna (Carnic Alps, Province of Udine). The study area is situated at 910 m asl, and consists of several rupicolous sites interspersed into the forest (predominant tree species: *Larix decidua, Picea abies, Abies alba, Fagus silvatica*).

Analysis of faeces is an effective method for studying lacertid lizard trophic ecology in the wild, and harmless to the animals (ANGELICI & al. 1998). Lizards were captured by hand or noosed, measured for snout-vent length (SVL, to the nearest ±1 mm), sexed, marked by toe-clipping, placed in small cages until defecation, and later set free at the site of capture. Faecal pellets analyzed were exclusively taken from the cages, never from the field. Faecal pellets were dissected and examined under a stereomicroscope; food items were identified to order level. In total, 81 faecal pellets from 81 lizard specimens (34 males, 28 females and 19 juveniles) were examined for food items. Statistical analyses were performed with SPSS® (version 6.0 for Windows®). All tests were executed two tailed, with alpha set at 5%. In cases where distribution of data was not normal (assessed by Kolmogorov-Smirnov test), non-parametric tests were used. Food niche breadth was calculated according to SIMPSON (1949). In the text, the arithmetic means are followed by ± one standard deviation.

RESULTS

Means and dispersion measures of SVL of males and females captured are given in figure 1. The sexes did not differ significantly in terms of SVL (one-way ANOVA: $F = 1.06$, $df = 1$, $n = 60$, $P < 0.30$), however, mean SVL in males (54.44 ± 4.97 mm) was longer than in females (53.00 ± 6.05). Juveniles were excluded from this analysis, as their SVL is much more influenced by their age than (maybe) by their sex.

The numbers and taxonomic allocations of the food items found in the faeces are presented in table 1. On the whole, *L. horvathi* fed mainly upon Opiliones (48.1% of the prey items identified) and upon Araneae (26.4 %). Interestingly, the proportion of Insects was quite low (8.5 %).

In total, the mean number of prey items per faeces was 2.61 ± 0.92. This value was higher in males (2.76 ± 1.13) than in females (2.68 ± 1.02) and juveniles (2.26 ± 0.81), but the differences between the three classes were not statistically significant (Kruskal-Wallis one-way ANOVA: $n = 81$, $df = 2$, $H = 3.31$, $P > 0.19$).

Food niche breadth was wider in males (3.56) than in females (2.92) and juveniles (2.59), but the between-group difference was not statistically significant (non-parametric correlation matrix Mantel test, at least $P > 0.3$ in all pairwise comparisons).

The frequency of the various prey types found in the faeces did not differ significantly between sexes ($\chi^2 = 6.93$, $df = 7$, $P > 0.43$).

DISCUSSION

The above analysis indicates that *L. horvathi* seems to be much less a food generalist than lacertid lizards generally are (e.g. see MOU 1987; DIAZ 1995; ANGELICI & al. 1997). The results of the present study clearly show that the diet of *L. horvathi* is almost exclusively based on ground-dwelling Arthropods and indicate a strong specialization towards Arachnids: Opiliones and Araneae complexively accounted for 74.5 % of the whole dietary composition, while the proportion of Insects was unexpectedly low. Comparing this prey spectrum with that of *A. fragilis* and *Zootoca vivipara* (JACQUIN, 1787) from the same geographic area (see LUISELLI 1992; LUISELLI & al. 1994; CAPIZZI and LUISELLI, unpublished data), Horvath's Rock Lizard turns out to be much more selective as far as the variety of prey taxa is concerned. *Anguis fragilis* preyed frequently upon non-arthropod organisms (earthworms and

Table 1: Number, proportional composition and taxonomic allocation of prey items found in 81 faecal pellets of 34 male, 28 female and 19 juvenile specimens of *Lacerta horvathi* from Tarvisio Forest (NE Italy).

Tab. 1: Anzahl, prozentuale Zusammensetzung und taxonomische Zuordnung der Beutetierreste aus 81 Kotproben von 34 Männchen, 28 Weibchen und 19 Jungtieren von *Lacerta horvathi* aus dem Wald von Tarvis (Nordostitalien).

	Males/Männchen		Females/Weibchen		Juveniles/Jungtiere		Total/Gesamt	
	(n=34)	%	(n=28)	%	(n=19)	%	(n=81)	%
Chilopoda	9	9,6	4	5,3	0	0,0	13	6,1
Isopoda	9	9,6	7	9,3	0	0,0	16	7,5
Opiliones	40	42,6	38	50,7	24	55,8	102	48,1
Araneae	26	27,7	20	26,7	10	23,3	56	26,4
Total Arachnida	66	70,2	58	77,3	34	79,1	158	74,5
Coleoptera adults	6	6,4	2	2,7	1	2,3	9	4,2
Hymaenoptera	2	2,1	2	2,7	1	2,3	5	2,4
Lepidoptera larvae	1	1,1	2	2,7	1	2,3	4	1,9
Total Insecta	9	9,6	6	8,0	3	7,0	18	8,5
Unidentified /Unbestimmt	1	1,1	0	0,0	6	14,0	7	3,3
Total /Gesamt	94		75		43		212	

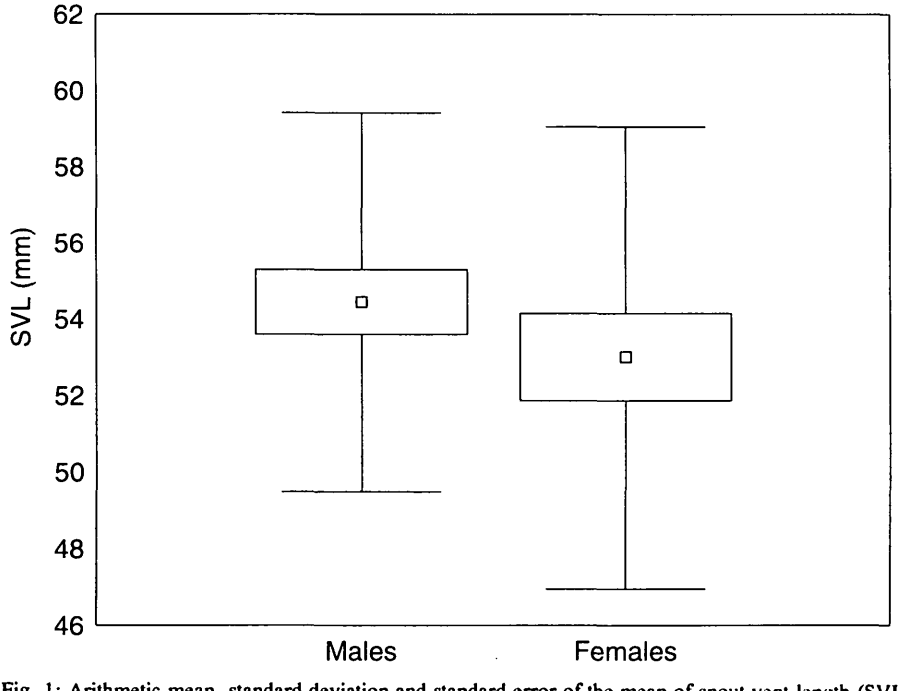

Fig. 1: Arithmetic mean, standard deviation and standard error of the mean of snout vent-length (SVL) in 34 male and 28 female *Lacerta horvathi* from Tarvisio Forest (NE Italy).
The sexes do not differ significantly in SVL (one-way ANOVA: $F=1.06$, $df=1$, $n=60$, $P<0.30$), but males (SVL: 54.44 ± 4.97 mm) were larger than females (SVL: 53.00 ± 6.05).

Abb. 1: Arithmetisches Mittel, Standardabweichung und Standardfehler des Mittelwertes der Kopf-Rumpflängen (SVL) bei 34 Männchen (Males) und 28 Weibchen (Females) von *Lacerta horvathi* aus dem Wald von Tarvis (Nordostitalien). Die Geschlechter unterscheiden sich nicht signifikant (ANOVA: $F = 1.06$, $df = 1, 60$, $P < 0.30$), doch waren die Männchen durchschnittlich größer (SVL: 54,44 ± 4,97 mm) als die Weibchen (SVL: 53,00 ± 6,05).

slug-snails), which was never observed in *L. horvathi*, while *Z. vivipara* was much more specialized in Insects (mainly Orthoptera and Homoptera).

However, it cannot be excluded that *L. horvathi* frequently preyed on spiders and opilionids simply because they were abundant in the field and not because of any selectivity in the foraging strategy. For answering this question it would be necessary to study the various prey categories' relative availability in the field, as was previously done in some lizard and snake studies (CAPIZZI & al. 1995; VICENTE & al. 1995; CAPIZZI & LUISELLI 196).

The types of prey eaten by *L. horvathi* suggest that this lizard is an active forager, as expected in small-sized rupicolous lacertids (AVERY & TOSINI 1995). Considering that many opilion and spider species tend to prefer humid places, *L. horvathi* is likely to select such humid microhabitats for hunting.

However, it is not possible to consider *A. fragilis* and *Z. vivipara* as food competitors of *L. horvathi*, as the former two species preferentially inhabit forested areas where debris accumulates, and are active on the ground, while the latter is strictly rupicolous and primarily active on vertical structures. The only potential food competitor of *L. horvathi* is *P. muralis*, which is also rupicolous. *Podarcis muralis* is, however, relatively rare in the Tarvisio Forest area and completely lacks in the study site. With regard to the Tarvisio Forest area, it should be noted that *P. muralis* is usually bound to anthropogenous structures, e.g. borders of roads, railways, and suburban sites. A small, relatively isolated Wall Lizard population, is present in the surroundings of Valbruna, at the borders of a forest road, approximately two kilometers from the study site. Despite this small distance, there was no interchange of individuals between the two places.

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