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Notes on feeding ecology of some Croatian populations of *Podarcis melisellensis* (Squamata, Lacertidae).

Valentin PÉREZ-MELLADO⁽¹⁾, Claudia CORTI⁽²⁾, Pietro LO CASCIO⁽³⁾,
Zaida ORTEGA⁽¹⁾, Eduard KLETECKI⁽⁴⁾ & Nicola TVRTKOVIĆ⁽⁴⁾

⁽¹⁾ Department of Animal Biology, University of Salamanca, Campus Miguel de Unamuno s/n - Edificio de Farmacia, 5ª Planta - 37071 Salamanca (Spain) < valentin@usal.es >

⁽²⁾ Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola" - Via Romana, 17 - 50125 Firenze (Italia).

⁽³⁾ Associazione Nesos - Via Vittorio Emanuele, 24 - 98055 Lipari (Messina) (Italia).

⁽⁴⁾ Croatian Natural History Museum - Demetrova 1 - 10000 Zagreb (Croatia).

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INTRODUCTION

Lacertid lizards are mainly insectivorous but in habitats with low abundance of arthropods, the consumption of plant matter could be an alternative. On small islands (islets) there is poor arthropod fauna (Janzen, 1973), thus, we can expect a higher consumption of plant material. This is the case of most of the insular species from genus *Podarcis* (Pérez-Mellado & Traveset, 1999; Van Damme, 1999). The information about feeding habits of the Dalmatian lizards is scarce (see, Tiedemann & Henle, 1986 and references therein). According to these authors the most common prey are: Oniscidea (Isopoda), Coleoptera, terrestrial Gastropoda, Araneae, Formicidae, Hemiptera, Ensifera and Diptera, while some island populations can include plant material in their diet. Because the Dalmatian lizard is present on several islands along the coast of Adriatic Sea (Tiedemann & Henle, 1986), we could expect significant differences in the diet of different populations, in relation with food availability and other factors as predation pressure. In this paper we give a preliminary description of the diet at nine insular populations of the Dalmatian lizard, *Podarcis melisellensis*.

MATERIAL AND METHODS

Study sites included six islands and islets of the so-called Vis archipelago (Central Dalmatia, Croatia): Vis /Lissa/, Biševo /Busi/, Jabuka /Pomo/, Brusnik

Table 1 a-b. Diet at different islands under study. For each locality, we give its surface (in km²) and maximum altitude (in meters above sea level). We include the percentage of each prey item (%) as well as the percentage of faeces with that prey item (%P). We give the number of seeds found in faeces and for vegetal matter the column % shows the average percentage of plant volume in the faecal sample of each locality and column %P the percentage of faeces with vegetal matter.

a	ISLAND											
	Jebuka		Brusnik		Vis		Mali Parzani		Bisevo		Mali Barjak	
Surface (km ²)	0.01		0.045		90.3		0.013		5.84		< 0.01	
Max. altitude (mt)	96		30		587		5		239		10	
Taxon	%	%P	%	%P	%	%P	%	%P	%	%P	%	%P
Gastropoda			20	40					1.6	3.2	1.65	3
Pseudoscorpionida											0.83	1.5
Araneae	3.45	16.7							1.6	3.2	8.26	15.2
Opilionida	3.45	16.7							0.8	1.6	1.65	3
Isopoda	3.45	16.7	10	20	4	10.5	14.28	100	25.6	49.2	33.88	60.6
Other Crustacea							4.76	33.3				
Diplopoda					2	5.3	4.76	33.3	3.2	6.3	0.83	1.5
Orthoptera					4	10.5			3.2	3.2	0.83	1.5
Dictyoptera									3.2	4.8		
Dermaptera											2.48	3
Homoptera	23.42	66.7			2	5.3			9.6	15.9	0.83	1.5
Heteroptera					6	15.8	9.52	66.7	1.6	3.2		
Diptera	13.79	66.7			12	26.3	4.76	33.3	5.6	11.1	5.78	10.6
Lepidoptera	3.45	16.7							0.8	1.6	2.48	4.5
Coleoptera	13.79	33.3	60	80	30	57.9	4.76	33.3	28.8	41.3	3.31	4.5
Hymenoptera	6.90	33.3			30	52.6	14.28	100	7.2	14.3	1.65	3
Formicidae	24.14	33.3					38.09	66.7	2.4	4.8	14.05	22.7
Arthropoda undet.					2	5.3			1.6	3.2	2.48	4.5
Arthropod. Larvae	3.45	16.7	10	20	2	5.3			1.6	3.2	10.74	19.7
Reptiles	3.45	20			2	5.3	4.76	33.33				
Seeds					4	10.5						
vegetal matter					40.5	10.5			5.5	3.2	55.0	13.6
TOTAL	29	6	10	5	50	19	21	3	125	63	121	66
B	6.62		3.35		4.88		4.84		5.83		5.98	
B _s	0.56		0.58		0.35				0.30		0.31	

/Melisello/, Mali Parzanj and Mali Barjak (see Tab. 1) inhabited with only one species of genus *Podarcis*, metapopulation of endemic Dalmatian wall lizard *P. melisellensis* (Braun, 1877), probably isolated from other populations of this species 1,2 - 1,9 Myr ago (Podnar *et al.*, 2004). Brusnik and Jabuka are the only volcanic islands in the Adriatic Sea (Bogdanovic & Mitic, 2003). Field sampling

b

	Hvar		Jerolim		Lukovac	
Surface (km ²)	299.7		0.03		< 0.01	
Max. altitude (mt)	628		22		5	
Taxon	%	%P	%	%P	%	%P
Psaudoscorpionida			3.3	10	1.8	6.6
Araneae	12.6	38.8	13.3	30	1.8	6.6
Isopoda					3.6	13.3
Other Crustacea					9	26.6
Diplopoda	2.8	11.1				
Orthoptera	1.4	5.5				
Homoptera	7	22.2	16.6	40		
Heteroptera	15.4	27.7	10	30		
Diptera	16.9	38.8	10	20	10.9	33.3
Coleoptera	18.3	38.8	13.3	30	23.6	53.3
Hymenoptera	9.8	22.2	20	20	5.4	20
Formicidae	2.8	5.5			38.1	53.3
Arthropoda undet.	8.4	33.3	10	30	5.4	20
Arthropoda Larvae	4.2	11.1	3.3	10		
Seeds					20	53.3
vegetal matter			2	10	21.3	53.3
TOTAL	71	18	30	10	55	15

was done in May 1997. We collected 145 fecal samples to perform the analysis. Separately, a field sampling (49 fecal pellets) was also conducted in August 2005 on the Island of Hvar and two surrounding islets, Jerolim and Lukovac. Fecal pellets were analyzed through a binocular microscope. In order to study diet composition we identified, measured and classified remains in a mixed scheme combining taxonomic orders and ontogenic stages (see for example Pérez-Mellado *et al.*, 1991). Diet composition was described by the relative prey presence (percentage of individuals consuming each item category (column % P, see Tab. 1a-b) and prey abundance (percentage of a given prey item relative to the total number of prey items (column %, see Tab. 1a-b). We compared trophic niche amplitude of *Podarcis melisellensis* with other lizard species by means of the standardized Levins's index of niche breadth (B_s). Intact body parts and whole prey items were measured to nearest 0.5 mm, and average prey sizes were compared amongst islands with available data employing a one-way ANOVA analysis.

RESULTS AND DISCUSSION

We found 518 prey items in 145 fecal pellets. Diet was rather variable among

islands (see Tab. 1). The important proportion of Coleoptera and other terrestrial prey indicate an active foraging of *P. melisellensis*. This type of foraging strategy is confirmed if we look, for example, at the diet of Mali Barjak or Biševo, where Isopoda are also important, this is a prey type characterized by being clumped and hidden (many individuals can be found *e.g.* under stones) indicating that these lizards are active foragers. Ant consumption, so common in some Western Mediterranean islands (Pérez-Mellado & Corti, 1993), was only frequent at smaller islets as Jabuka and Mali Parzanj. Thus, it seems that lizards preyed on this food items only at sites characterized by very poor trophic availability. It is confirmed by the results concerning the summer diet on Hvar and the surrounding islets (156 prey items in 49 fecal pellets, see Tab. 1b), where ants are largely consumed only at the smallest one (Lukovac).

Niche breath values were similar or slightly higher than those recorded from other Mediterranean islands (Pérez-Mellado & Corti, 1993). In our limited sample, vegetal matter was less common than in other populations of the Central and Western Mediterranean. However, Gelineo & Gelineo (1963) recorded the consumption of unripe fruits of *Capparis rupestris* at Brusnik, where we did not find any vegetal remain. Radovanovic too (1956, in Tiedemann & Henle, 1986) found plant material in the diet of this species. The highest presence of plant matter corresponds to Mali Barjak and Lukovac.

At Lukovac vegetal remains consist mainly of seeds of *Capparis rupestris*, which represents the most common plant species among the scarce vegetation occurring on this islet. On the contrary on the small islet of Jerolim, where pine trees and high macchia occur, data just indicate low plant matter consumption., the smallest islet under study. But we would need a larger sample from several localities to confirm if *P. melisellensis* can be considered an insular omnivorous lizard or mainly insectivorous one, as it was recorded for *Podarcis raffonei* from Aeolian Islands where in any case vegetal matter is also well represented (Luiselli *et al.*, 2004; Lo Cascio, 2006).

In addition, we found some remains of *Podarcis*, probably indicating the existence of cannibalism, as already observed (see, Tiedemann & Henle, 1986 and references therein). The presence of lizard remains suggests, as observed for other populations, the existence of aggressive encounters among individuals, resulting in tail autotomy or digit clipping, with consequent occasional ingestion (Amat *et al.*, 2008), or cannibalism of juvenile specimens. This behavior was observed in insular lizard populations submitted to intense prey competition because of high lizard density or because of environments characterized by low prey availability (Pérez-Mellado, 1989; Pérez-Mellado & Corti, 1993; Luiselli *et al.*, 2004 and references therein). In average, *P. melisellensis* captured preys of 4.36 ± 0.19 mm (range: 1.5-15 mm, n = 104 prey measured). We did not find significant differences among the four populations under study from which we had prey measure-

ments (one-way ANOVA, $F = 1.037$, $P = 0.38$, homogeneous variances, Levene test, $F = 0.308$, $P = 0.82$). Thus, prey size was similar in spite of the potential differences due to the different prey availability on the different islands.

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