ECOLOGIA BALKANICA

2011, Vol. 3, Issue 1 July 2011 pp. 69-73

Data on food composition of Phrynocephalus horvathi Méhely, 1894 (Reptilia: Agamidae) in Mount Ararat (Northeastern Anatolia, Turkey)

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Abstract. The study presents data on the food composition of Horváth's toad-headed agama, *Phrynocephalus horvathi,* in northern slopes of Mount Ararat (Aralık, Iğdır). A total of 294 prey items were determined in the digestive systems of 36 (8 males, 11 females, and 16 juveniles) individuals examined in the study. Prey groups in the food composition are included in Aranea (1.4%), Orthoptera (1.0%), Hymenoptera (73.5%), Coleoptera (23.1%) and Diptera (1.0%). No significant difference was observed between sexes regarding food composition. Consequently, *Phrynocephalus horvathi* is partially myrmecophagous (73.5%) and an active predator.

Key words: *Phrynocephalus horvathi,* Food composition, Northeastern Anatolia, Turkey.

Introduction

The toad-headed agamas of the genus, *Phrynocephalus* Kaup, 1825 include 37 species distributed in the arid zones of south and southeastern Europe, Middle Asia, north-western China, Iran, Afghanistan, Pakistan, northern Africa and Arabian Peninsula (ANDERSON, 1999; ANANJEVA *et al.*, 2006; BARBANOV & ANANJEVA, 2007). Together with the lizards of the genus *Eremias*, *Phrynocephalus* represents a core of the Palearctic fauna of deserts (ANANJEVA *et al.*, 2006). *Phrynocephalus horvathi* occurs in the Araks River valley of Armenia, Turkey, Nakhichevan (Azerbaijan), and north-western Iran (MELNIKOV *et al.*, 2008).

The Horváth's toad-headed agama generally lives in open desert landscapes, saltwort and wormwood semi-desert with sparse xerophytic herbaceous vegetation and takyr-like (clay desert) soils (ANANJEVA *et al.*, 2006; ANANJEVA & AGASYAN, 2008). Declining population of *P. horvathi* in Armenia requires special protection programs as its habitat is significantly fragmented by land conversion, intensive agriculture and urbanization (ANANJEVA & AGASYAN, 2008). On the other hand, there is no important anthropogenic pressure on the population in Turkey.

There are some studies on the taxonomic status of the species of genus *Phrynoephalus* (e.g. BARABANOV & ANANJEVA, 2007; MELNIKOV *et al.*, 2008), as well as on their distribution (ANANJEVA *et al.*, 2006), population dynamics and ecology (e.g. SHAMMAKOV, 1981; SHENBROT, 1987; ANANJEVA & SHAMMAKOV, 1985), age structure and life history (SMIRINA &

ANANJEVA, 2001); however, there is still lack of information on feeding habits of the species in Turkey.

The aim of the present study is to present the food composition of Horváth's toad-headed agama from northeastern Anatolia (Iğdır, Turkey).

Material and methods

In the study, 36 preserved specimens of *P. horvathi* (8 males, 11 females, and 16 juveniles) were examined, collected between 25 June and 27 August 2010 from sand dunes in Aralık (Lat: 39.863483°N, Long: 44.505245°E, 826 m a.s.l.), and Iğdır Province of Turkey [collected as a priority for determining the herpetofauna of Iğdır]. The material was registered in the Museum of Faculty of Art and Science, Onsekiz Mart University and incorporated into the collection of ZDEU-ÇOMU (Zoology Department Ege University-Çanakkale Onsekiz Mart University), Turkey. The species syntopically inhabits with *Eremias pleiskei*, *E. strauchi*, *Laudakia caucasica*.

Body length (SVL) and total length (TL) of the specimens were measured using calipers to the nearest 0.1 mm and recorded; in addition, sexes were determined. After these procedures, they were dissected and their digestive tracts were removed. The obtained food contents were preserved in 70% ethanol for later analysis. Food contents were identified to the lowest possible taxa. Vegetal materials, sand and little pebbles were also encountered in the food content. However, these materials were most likely ingested accidentally during foraging and not considered as food.

The food contents were presented both in numeric proportion (n%) and frequency of occurrence (f%). Sexual food niche overlap was measured using PIANKA'S overlap index (1973). This index varies between 0 (no similarity) and 1 (totally similar). Food-niche breadth was determined using SHANNON'S index (1948). All niche calculations were done using the "EcoSim 700" program (GOTELLI & ENTSMINGER, 2010). T-test and Mann-Whitney U test were used to compare the sexes; statistical analyses were performed using SPSS 10.0, and the alpha level was set at 0.05. In the results section, the mean values are given with their standard deviations.

Results

In the study, 36 individuals of *P. horvathi* (8 males, 11 females, and 17 juveniles) from Aralık (Iğdır) were examined. The mean body length (SVL) was 27.8±3.02 (22.0 – 33.3) mm for juveniles, 42.7±5.63 (34.3 – 49.4) mm for males and 45.6±4.88 (36.7 – 54.0) mm for females. The mean total length (TL) was determined as 57.9±6.38 (45.6 – 68.3) mm in juveniles, 93.9±12.45 (77.2 – 110.3) mm in males and 93.9±8.88 (76.8 – 108.7) mm in females. No statistically significant difference was observed between sexes in terms of their sizes (SVL: $t=1.254$ $p\leq0.225$; TL: $t=1.109$, $p\leq0.281$).

In the stomach contents of 36 individuals, 294 prey items, with body lengths ranging from 2 to 30 mm, were determined with a median (±SD) number of 8.0±5.09 (range= 1-20). The number of median prey items was 5.0±4.63 (1-20) in juveniles, 11.0±4.60 (1-16) in males, and 11±4.72 (2-18) in females. No statistically significant difference was detected between sexes regarding the number of prey items in the stomach (Mann-Whitney U test, $Z=0.000$, $p\leq1.000$); however, there was a significant difference between juveniles and adults (Mann-Whitney U test, $Z=2.991$, $p\leq0.003$). Juveniles consume smaller (1-20 mm) and fewer prey objects than do adults.

Aranea (n%=1.4%), Orthoptera (1.0%), Hymenoptera (73.5%), Coleoptera (23.1%) and Diptera (1.1%) are the prey groups included in the food content. Among the prey taxa shown in Table 1, Formicidae (n%=73.5, f%=88.9%) and Coleoptera (23.1%, 66.7%) were frequently consumed by Horváth's toad-headed agama. More active prey species like Aranea, Orthoptera, and Diptera were encountered less frequently in the food content. According to the Pianka's niche overlap index, food compositions of sexes are mostly similar (males vs. females = 0.99, males vs. juveniles = 0.99, females vs. juveniles = 1.00). This indicates that feeding habit is not changed with age and that the same microhabitat is used for foraging. Food

niche breadth (Shannon's index) was 1.06, 0.80 and 0.67 in males, females and juveniles, respectively. No difference was observed among the sexes. Moreover, food spectrum of the species is rather limited according to the index value.

Table 1. Food composition of the Horváth's toad-headed agama from Northeastern Anatolia. n%: numeric proportion, f %: frequency of occurrence.

Prey Taxa	n (%)				f (%)			
	Juvenile	Male	Female	Total	Juvenile	Male	Female	Total
ARACHNIDA		4 (4.8)		4 (1.4)		4 (50.0)		4 (11.1)
Aranea, Lycocidae		4 (4.8)		4 (1.4)		4 (50.0)		4 (11.1)
			116	290				
INSECTA	94 (100)	80 (95.2)	(100)	(98.6)	17 (100)	8 (100)	11 (100)	36 (100)
Orthoptera		3 (3.6)		3 (1.0)		2 (25.0)		2 (5.6)
Hymenoptera,				216				
Formicidae	73 (77.7)	56 (66.7)	87 (75.0)	(73.5)	14 (82.4)	7 (87.5)	11 (100)	32 (88.9)
Coleoptera (total)	21 (22.3)	21 (25.0)	26 (22.4)	68 (23.1)	8 (47.1)	7 (87.5)	9 (81.8)	24 (66.7)
Coleoptera, Larvae	14 (14.9)	11 (13.1)	13 (11.2)	38 (12.9)	8 (47.1)	5 (62.5)	5 (45.5)	18 (50.0)
Coleoptera, Carabidae	2 (2.1)	2 (2.4)	6 (5.2)	10 (3.4)	1 (5.9)	1 (12.5)	4 (36.4)	6 (16.7)
Coleoptera, Coccinellidae	5 (5.3)	5 (6.0)	6 (5.2)	16 (5.4)	3 (17.6)	3 (37.5)	4 (36.4)	10 (27.8)
Coleoptera, Scarabaeidae		3 (3.6)	1 (0.9)	4 (1.4)		3 (37.5)	1 (9.1)	4 (11.1)
Diptera, Muscidae			3 (2.6)	3 (1.0)			3 (27.3)	3 (8.3)
vegetal material						1 (12.5)	1 (9.1)	2 (5.5)
sand and little pebbles e.g.					12 (70.6)	6 (75.0)	9 (81.1)	27 (75.0)
Number of prey items	**94**	**84**	**116**	**294**				

Discussion

Our study results demonstrated that Horváth's toad-headed agama mostly consumed slow insects, especially Formicidae and Coleoptera. In contrast, more active and flying prey species included in Aranea, Diptera and Orthoptera were encountered less frequently in the food composition. Ants, coleopterans and other small insects (*Locusta* sp.), larvae, and spiders were reported to form the food composition of the species (TERENTEV & CHERNOV, 1965; BAŞOĞLU & BARAN, 1977; ANDERSON, 1999).

Widely-foraging predators encounter and consume mostly non-moving types of prey items (PIANKA, 1966). PERRY & PIANKA (1997) stated that external, internal and evolutionary factors were important for determining the foraging behaviour; widely foraging species used their visual and smelling senses while hunting, and food niche breadth is rather narrow. Due to the limited prey range of *P. horvathi* and less active prey species in the food composition, it could be included in the widely foraging species.

Ants and termites are frequently encountered in the food composition of agamids (e.g. PIANKA & PIANKA, 1970; HUEY & PIANKA, 1981; DÜŞEN & ÖZ 2001; HUEY *et al*., 2001). *Phrynocephalus versicolor* commonly consumes ants in summer months (84%), and carabids (11%) are their other important prey objects (QUAN *et al*., 2006). Important food overlap was observed in *Eremias multiocellata*, *E. argus*, and *P. frontalis* which live syntopically (CHEN, 1997).

DÜŞEN & ÖZ (2001) determined that Hymenoptera (72.21%) and especially the Formicidae (49.83%) were mostly present in the food composition of *Laudakia stellio.* On the other hand, Formicidae were also important prey of *Uma paraphygas* and *U. exsul* (GADSDEN & PALACIOS-ORONA, 1997; GADSDEN *et al*., 2001). In addition, agamids

have positive energy balance, and there is always food in the stomach of ant-eating agamids (HUEY *et al.*, 2001). None of the individuals examined in the study had an empty stomach, and there was at least one prey object. This finding supports the hypothesis.

In conclusion, the food composition of Horváth's toad-headed agama, *P. horvathi*, is mostly composed of slow-moving prey items. However, more active and good flying prey species were less encountered in the food composition. The species is partially myrmecophagous and a widely foraging hunter that consumes slow-moving prey items, especially ants and coleopterans.

Acknowledgements

This study constitutes part of a project [Project No: 108T559] supported by TÜBİTAK (The Scientific and Technological Research Council of Turkey). We are indebted to TÜBİTAK for the financial support it has provided.

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Received: 03.01.2011
Accepted: 01.02.2011