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Trophical spectrum of a *Bombina variegata* population from Vadu Crişului (Bihor County, Romania)

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Abstract. We studied the trophical spectrum of *Bombina variegata* species from Vadu Crişului, Bihor County. The study was realized during the period May-June 2005. We observed certain differences in feeding between males and females. At the same time there is a difference between the two periods of study. These differences may appear because of the temperature changes or because of the preferences of sexes for various preys. The feeding intensity is proportional with the temperature raising. The studied stomachs contain animal prey and at the same time we found vegetal fragments and shed skin. The most important preys for males were from Cladocera and Coleoptera order and for the females the biggest source of food was Coleoptera and Formicida.

Keywords: *food composition, Bombina variegata, males, females, juveniles*

Introduction

Food is a primary link between an animal and its environment (Kennett & Troy 1996). Most of the amphibians, feeding both in aquatic and terrestrial habitats, appeal to very diverse food resources. Amphibians spend a long time of their life obtaining the prey and this activity is the key factor of their ecology (Perry et al. 1990) and it is considered the most important one, because as long as the energetic requirements are not satisfied, the other behavior models do not receive an adaptation value (Avery 1976).

During the years, there were realized studies concerning the trophical spectrum of the European species of the genus *Bombina* (*Bombina bombina* - eg. Ščerbak & Ščerban 1980; Tertyshnikov & Goroyava 1982; Sas et al. 2003a, 2004a; *Bombina variegata* - Ščerbak & Ščerban 1980; Kuzmin 1990; Nemes & Petrás 2003; Sas et al. 2004b, 2005a,b; Ghiurcă & Zaharia 2005) as well as the diet composition of some hybrid populations among them (Sas et al. 2005c). From these studies only one analyses the trophical spectrum of *Bombina variegata* species depending on frogs' sex but it accumulates the data of a one year study period (Sas et al. 2005a).

The objective of our study was to examine the differences that appear in the feeding habits of males and females of *Bombina variegata* for a shorter period of time represented by their first breeding season in Romania.

Materials and Methods

The study was made in May and June of the year 2005 using a sample formed by 61 individuals belonging to a population from Vadu Crişului. The studied habitat is located in Vadu Crişului Village in Pădurea Craiului Mountains at an approximate 400 m altitude and it is formed by three ponds. The biggest one has a 6 m^2 surface, the middle one approximate 4 m^2 and the smallest pond a surface of 1 m^2. The middle pond is situated at an approximate 3 m distance from the biggest one and the smallest pond at a 5 m distance from the first two ones. The bottom of the ponds is covered with dried leafs dropped by the trees from the forest which is there. The biggest pond has a 30 cm depth and the two others 10-15 cm. The twigs and leafs fallen in the ponds' water help a lot the yellow-bellied toad to camouflage. At the first outcome all the three ponds had water. By the second outcome only the biggest one had water, the smallest pond being completely dried up and the middle one had the substratum a little damp.

The animals were captured with the help of a metallic rectangular dredge and put in buckets with water. The method used to obtain the stomach contents was the stomach flushing method (Legler & Sullivan 1979; Opatrny 1980; Joly 1987; Cogălniceanu 1997), using a syringe with a piece of perfusion tube at one extremity. The stomach contents were collected immediately after capturing because amphibians digest prey rapidly (Caldwell 1996). Right away after this operation the toads were released. The stomach contents were placed in airtight test tubes, preserved with a 4% solution of formalin and analyzed in the laboratory with the aid of a binocular magnifier, using for preys' determination the specialty literature (Moczar et al. 1950; Radu & Radu 1967, 1972; Ionescu et al. 1971; Crişan & Mureşan 1999; Crişan & Cupşa 1999).

The studied parameters of the trophical spectrum in this study were: the taxa affiliation of the consumed preys, the variation of the maximum and average number of preys / stomach, the amount of the prey items, and the frequency by which frogs consumed a certain taxa and the affiliation of the identified preys regarding the provenience environment aquatic or terrestrial.

Results

We identified in the collected stomach contents animal type preys as well as plant materials and shed skin remains (Table 1).

There are no differences between the two sexes regarding the consumption of vegetal and shed skin fragments, but there are significant differences depending on the studied month.

We identified a number of 560 prey items from the stomach contents, determined as belonging to 27 categories. Most of the consumed prey items having small proportions were totalized as others in the table mentioned above and only those which have importance for frogs' feeding are presented. The only numerical insignificant item which has to be mentioned is represented by tadpoles.

Both the maximum and average number of prey items / individual is higher at males. In the same time, the maximum and average number of preys / stomach is larger in 6 June.

There are differences regarding the feeding of males and females, they use different prey categories. Both for males and females of *Bombina variegata*, items such as Coleoptera and Formicida are important and there are differences only at the amount's values of them. Other important taxa from the trophical point of view are Cladocera but only for males and Araneae for females.

Table.1 The frequency of stomachs with vegetal, shed skin; the total, maximum and average number of prey items / sample; The prey amount; The amount of the aquatic and terrestrial preys

	Sex		Collecting period	
	Males	Females	27.05.05	6.06.05
	The frequency of stomachs with shed skin and vegetal			
% Stom. with vegetal	46.66	50	29.03	70
% Stom. with shed skin	18.6	22.22	16.13	23
	The average and maximum number of preys / sample			
Average no. of preys / sample	9.32	8.83	8.32	10.06
Maximum no. of preys / sample	47	14	14	47
Total no. of preys	401	159	258	302
	The provenience environment of preys			
No. of aquatic preys	134	17	22	129
No. of terrestrial preys	267	142	236	173
	The amount of prey items			
Oligochaeta	0.24	2.51	-	1.65
Isopoda	0.49	1.25	0.38	0.99
Cladocera	26.18	-	-	34.76
Araneae	5.73	10.06	12.79	1.98
Myriapoda Chilopoda	1.24	0.62	1.16	0.99
Myriapoda Diplopoda	-	1.88	1.16	-
Collembola	1.49	0.62	2.32	0.33
Blattaria	1.74	1.88	3.87	-
Homoptera Cicadina	2.24	-	3.48	-
Coleoptera-larve	6.72	10.68	8.52	7.28
Coleoptera-imago	31.15	35.19	34.47	30.44
Diptera Nematocera-imago	6.48	7.54	9.68	4.3
Hymenoptera-undet.	1.49	2.51	2.32	1.32
Hymenoptera Formicida	10.97	20.12	16.27	11.25
Lepidoptera-larva	0.74	1.88	0.38	1.65
Tadpoles	-	0.62	-	0.33
Others	3.1	2.64	3.2	2.73

Discussion

The food of the studied yellow-bellied toads is especially made up by invertebrates. We consider vegetal remains and shed skins being accidentally present in the stomach contents. Plant materials are most probably ingested together with the captured animal prey. After some researchers the consumption of molted skin represents, in fact, a process of epidermal protein recycling (Weldon et al. 1993). A situation like this was detected at other *Bombina variegata* populations too, but the researchers consider, however, the presence of shed skins accidentally in the stomach contents analyzed by them (Sas et al. 2005b).

The most important food sources of the yellow-bellied toads are represented by invertebrates. The prey categories identified in the stomach contents are connected with the environmental factors being certain differences between the two studied periods (Table 1). Thus the phase between the two periods of the study is characterized by the absence of precipitations and excessive heat which makes the diet composition of the yellow-bellied toads to be lacking in species fond of humidity.

Although the main food source is represented by invertebrates, along our study we discovered a tadpole in the stomach content of a female toad. This situation is due to the fact that amphibians capture any kind of prey from their habitat which has a suitable size in order to be swallowed (Torok & Csorgo 1992). The presence of this tadpole in the stomach content of the respective female may be connected with the fact that because of the drought the frogs remain at the side of the pond and feed on everything that it offers them.

The amount of different prey items in the food of females and males indicates the use of separate feeding strategies. Thus, males use the feeding strategy of "active-foraging" (Huey & Pianka 1981) that is

searching for preys. Meanwhile, females prefer a feeding type of "sit-and-wait" (Perry & Pianka 1997) because females need a lot of energy and nourishing substance in order to developing eggs (Sas et al 2005b).

The feeding intensity is higher at males because their consumption of smaller prey items leads to the swallowing of more prey individuals than females do. In the same time, a consumption of prey items with larger size is more favorable for females, they being such able to cover the energetic requirements from a smaller number of preys but richer in energetic content (Low & Torok 1998). A generalization shows us that the studied *Bombina variegata* population feeds mostly on terrestrial preys and males are bigger consumers of aquatic preys than females.

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