Data regarding the trophic spectrum of a population of *Rana esculenta* Complex from Bacău County

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Abstract. We analyzed the trophic spectrum of one population of *Rana esculenta* complex collected, placed close to the lake accumulation Bacău II. The most abundant prey taxons in the food of edible frog are species from Coleoptera order, followed by Hymenoptera and Diptera among insects and Aranee among spiders. We identified a great number of gregarious small species (Formicidae) showing an opportunistic predator behavior of this frogs, using the sit and wait foraging behavior. The terrestrial preys prevail in comparison with aquatic organisms.

Key words: trophic spectrum, prey taxa, *Rana esculenta* complex,

Introduction

The species and the hybrid form belonging to *Rana esculenta* complex are widespread in Romania allover in plane area becoming rare in hill regions (Cogălniceanu et al. 2000a). In Romania the species *Rana ridibunda* up to 700 m altitude (in padurea Craiului Mountains – Covaciu-Marcov et al. 2003a) when the species *Rana lessonae* and the hybrid *Rana* kl. *esculenta* up to 200 respectively to 300 m altitude (Covaciu-Marcov 2004). The trophic spectum of some green frog populations made the research object of some recent studies (e.g. Lőw et al., 1990, Török & Csörgő, 1992; Ghira et al. 1997, Cogălniceanu et al. 2000b, Covaciu-Marcov et al., 2000, 2003b, Nicoară et al. 2005, Sas et al. 2005a).

Our study on the trophic spectrum of the species of *Rana esculenta* complex comprises only one period (August-September). The study focused on the identification of taxonomic groups which represents the prey of edible frog (both the number of species and specimen), and also, on the occurrence frequency of different categories of organisms.

Material and Methods

The pod from which the sample was collected is placed in the North part of Bacău town, close to course of Bistriţa River (Bacău II Lake) at 100 m. The habitat has a surface of 300 m^2 out of which 25 % is covered with duckweed. The pond is 1 m deep and the bottom covered with a 30-40 cm layer of mud. There were analyzed a total number of 104 stomach contents belonging to the species of *Rana esculenta* complex. The samples collected by the means of the stomach flushing method (see in Cogălniceanu 1997), thus were used a syringe with a tube attached. The time between capture and stomach content collecting was shorten due to the rapid digestion which occurs in frogs. The water was introduced gradually and very slowly to avoid hurting the frogs. This method allows sample to be collected from frogs' natural environment without affecting the population. The stomach content was preserved in technical alcohol, being identified with stereomicroscope and specific key (Reitter 1912, Radu & Radu 1967, Paulian 1971, Jeauniaux 1996, Chinery 1998). The diversity of the diet was estimated with Shannon-Weaver (1949) diversity index (*H*).

Results

There were analyzed 104 individuals belonging to *Rana esculenta* complex (table 1). Only a few number of studied samples had no stomach contents (3.84 %). In the stomach contents we identified besides the contents of animal prey, as well as vegetal remains in high proportion (48.07%) (table 1). We established the taxa affiliation for the prey animals and the feeding intensity. The 292 consumed animals were grouped in 26 major categories of invertebrate (see the grey lines in tabel 2). The other prey categories (consumed in low amounts and making part of the detailed prey taxa identification) had no importance in the feeding of the green frogs and we will counted these, only to estimate the food niche breath and overlap. The diversity of the food (according to Shannon-Weaver index) for the whole period was *H*=2.51.

Table 1 The percentage of stomachs with vegetal debris, only with vegetal matters, empty stomach, with other type ingested matters

No. of analyzed samples	Stomach with vegetal debris (%)	Stomach only with vegetal debris (%)	Empty stomach (%)	Stomach with other type ingested matters (%)
104	48.07 %	5.76 %	3.84 %	5.76 %

Also, we tried a detailed prey determination to family level (table 2) and for some specimens the identification was possible at genus and species level. In this manner we identified species or genus, such as: *Pyrrhocoris apterus* (Heteroptera), *Apis* sp. (Hymenoptera), *Volucella* sp. (Diptera). From Coleoptera order we identified the highest number of specimens, both adults and larvae. We recorded specimens belonging to a number of 9 families (table 2). Some bug specimens were identified at genera level such as: *Calathus* sp., *Cychrus* sp., *Abax* sp., *Pterostichus* sp., *Necrophorus* sp. and even species: *Abax ovalis*, *Harpalus pubescens*, *Harpalus serripes*, *Opatrum sabulosum* and *Leptinotarsa decemlineata*. There were identified a few vertebrates among the prey:

Albunoides bipunctatus (Pisces), *Rana ridibunda* (Amphibia), *Natrix natrix* (Reptilia), *Muridae* sp. (Mamalia).

Table 2 The number and the amount (%) of prey taxa

Taxa	Specimens no.	Amount (%)	Life environment
Gastropoda	2	0.67	Aquatic
Lamellibranchia	1	0.33	Aquatic
Clitellata – total	5	1.69	
Oligochaeta	2	0.67	Terrestrial
Hirudinea	3	1.02	Aquatic
Crustacea – total	4	1.35	
Isopoda	4	1.35	Terrestrial
Miriapoda – total	3	1.01	Terrestrial
Diplopoda	1	0.34	Terrestrial
Chilopoda	2	0.67	Terrestrial
Arahnida – total	20	6.77	
Arahnida – unid.	2	0.67	Terrestrial
Acarina	2	0.67	Terrestrial
Araneea – unid.	14	4.74	Terrestrial
Opiliones – unid.	2	0.67	Terrestrial
Ephemeroptera - larvae	9	3.05	Aquatic
Odonata - larvae	8	2.71	Aquatic
Orthoptera	2	0.67	Terrestrial
Saltatoria	1	0.33	Terrestrial
Homoptera – total	9	3.05	Terrestrial
Ciccadelidae	3	1.02	Terrestrial
Aphidae	6	2.03	Terrestrial
Heteroptera – total	17	5.76	
Heteroptera – unid.	6	2.03	Aquatic
Pentatomidae	1	0.33	Terrestrial
Pyrrhocoridae	4	1.35	Terrestrial
Nabidae	1	0.33	Terrestrial
Corixidae	5	1.69	Aquatic
Coleoptera – total	73	24.74	
Coleoptera – unid.	3	1.02	Terrestrial
Carabidae	20	6.77	Terrestrial
Carabidae – larvae	1	0.34	Terrestrial
Tenebrionidae	3	1.02	Terrestrial
Silphidae – larvae	4	1.35	Terrestrial
Dytiscidae	5	1.69	Aquatic
Dytiscidae – larvae	2	0.67	Aquatic
Curculionidae	16	5.42	Terrestrial
Haltucinae	1	0.33	Terrestrial
Crysomelidae	13	4.4	Terrestrial
Crysomelidae – larvae	2	0.67	Terrestrial
Coccinelidae	1	0.34	Terrestrial
Staphilinidae	2	0.67	Terrestrial
Dermaptera – total	5	1.69	
Forficulidae – unid.	5	1.69	Terrestrial
Lepidoptera – total	28	9.84	
Lepidoptera – unid.	5	1.69	Terrestrial
Lepidoptera – larvae	1	0.34	Terrestrial
Arctiidae	1	0.33	Terrestrial
Geometridae	2	0.67	Terrestrial
Geometridae – larvae	12	4.06	Terrestrial
Noctuidae	1	0.34	Terrestrial
Noctuidae - larvae	6	2.03	Terrestrial
Mecoptera	1	0.33	Terrestrial
Diptera – total	35	11.86	
Diptera – unid.	7	2.37	Terrestrial
Diptera – larvae	1	0.34	Terrestrial
Syrphidae	5	1.69	Terrestrial
Tipulidae – larvae	1	0.33	Aquatic
Phoridae	2	0.67	Terrestrial
Psilidae	1	0.33	Terrestrial
Calliphoridae	13	4.4	Terrestrial
Homocera	1	0.34	Terrestrial
Bombyliidae	1	0.33	Terrestrial
Stratyomiidae – larvae	1	0.34	Aquatic
Muscidae	2	0.67	Terrestrial
Hymenoptera – total	61	20.67	
Hymenoptera – unid.	7	2.37	Terrestrial
Formicidae	29	9.83	Terrestrial
Apidae	22	7.45	Terrestrial
Ichneumonidae	1	0.34	Terrestrial
Tenthredinidae	1	0.33	Terrestrial
Torymidae	1	0.34	Terrestrial
Pisces – total	4	1.35	Aquatic
Cyprinidae	4	1.35	Aquatic
Amphibia – total	1	1.34	
Ranidae	1	1.34	Aquatic
Reptilia – total	1	0.33	
Colubridae	1	0.33	Aquatic
Mamalia – total	2	0.67	Terrestrial
Muridae	2	0.67	Terrestrial

Discussions

The reduced number of empty stomachs indicates that there were optimal feeding conditions. The amphibian diet is mainly made up by invertebrates. Also, the adults are thought as carnivorous animals and only their larvae eat vegetal food. There was establishing a strong relationship between the vegetal debris and animal food recorded in the analyzed stomach content. We identified a small number of sample only with vegetal matters (6 out of 104, meaning 5.76 %), which lead us to the conclusion that the debris are accidentally ingested along with the prey. The studied literature mention at the amphibians, that the vegetal food found in adults stomach were ingested accidentally along with their prey (e.g. Covaciu-Marcov et al 2003c, Sas et al. 2003a, Ghiurcă & Zaharia 2005).

The most important category of stomach contents consists of animal nature preys, considering the fact that adults' amphibians are predators (Cogălniceanu et al. 2000b) spending a long period of their life searching for food which is a key preoccupation in their ecology (Perry et al. 1990). The amphibians eat mostly invertebrate preys, hunted from terrestrial and aquatic environment. We identified both aquatic and terrestrial prey in the analyzed stomach contents thus the highest amount were recorded by terrestrial taxons, represented both mostly by insects (249 preys out of 292). Mostly the amphibians, such as Ranidae, that hunting in terrestrial environment eat in high amount insects (e.g.

Covaciu-Marcov et al. 2001, Sas et al. 2003b, Aszalos et al. 2005). The other amphibian species, that spend a long time in the aquatic environment feed mostly with aquatic Crustaceeans (e.g. species from *Bombina* genus – Sas et al. 2003c, Sas et al. 2005b; species from *Triturus* genus – Covaciu-Marcov et al. 2002, Cicort et al. 2005). Is important the consumption of some vertebrates by the analyzed frogs. In the specialty literature was recorded many cases when the green frogs eat vertebrates, such as: fish's (e.g. Covaciu-Marcov et al. 2000, Covaciu et al. 2005), amphibians (e.g. Cogalniceanu et al. 2000b, Covaciu-Marcov et al. 2004), reptiles (e.g. Opatrný 1968) and rodent's (Cristea et al. 1972, Sas et al. 2004).

The high diet diversity, recorded at the studied population, corresponds with those existing in the specialty literature. The species from *Rana esculenta* complex have a continuous activity, occupying a large variety of habitats, a fact which leads to the high diversity of the captured preys (Cogălniceanu et al. 2000b). It is known that large-bodied predators such as edible frogs eat a larger variety of prey items than smaller predators (Cohen et al. 1993). The *Rana esculenta* complex's species as well as the moor frog have the most diverse composition of the consumed prey items (Török & Csörgő 1992; Kovács & Török 1992).

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