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DIET COMPOSITION DURING BREEDING PERIOD IN POPULATIONS OF BUFO VIRIDIS, *PELOBATES FUSCUS* AND *RANA ESCULENTA* COMPLEX FROM CIRIC RIVER'S BASIN (IAŞI, ROMANIA)

BY

ANDREEA NICOARĂ[1], MIRCEA NICOARĂ[1], FLAVIANO BIANCHINI[2]

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We analysed stomach content of three anuran species sampled in Ciric River's basin, near Iasi town in March-June 2004. 1263 prey specimens were identified in the 143 individuals collected. Class Insecta species were dominant among all preys found. In *Bufo viridis* 95.25% of the preys were insects, suited by arachnids - 2%. In *Pelobates fuscus*, insects represented 74.19% and arachnids 16.12%, while in *Rana esculenta* complex, 82.52% were insects and 10.22% crustaceans. In *Bufo viridis*, terrestrial species were dominant (94%), indicating prey selectivity as shown by the high percentage of Formicidae (65%) found in the stomachs. In *Pelobates fuscus*'s food, a dominance of terrestrial coleopterans was recorded. Data regarding *Rana esculenta* complex emphasised a balanced feeding both with aquatic preys and terrestrial ones. For the 3 species populating the same microhabitats in the reproduction period, an overlapping of the food niches of 13.84% was calculated.

Introduction

Amphibians are important components of ecosystems, because of their role to direct energy from invertebrates to superior trophic levels. In this study we compared food spectra of species *Bufo viridis*, *Pelobates fuscus* and *Rana esculenta* complex. We studied trophic interactions between the 3 species during the breeding period.

Material and methods

Biological material was sampled in Ciric River basin, Iaşi county, during March-June 2004. We analysed stomach contents of 143 individuals of *Bufo viridis*, *Pelobates fuscus* and *Rana esculenta* complex. Collecting was made by stomachal flushing method and the content was kept in absolute ethanol. For preys identification we utilised binocular. We calculated relative abundance of preys (Ar% = percentage of the total number of preys accounted for each prey type), frequency of occurrence (F% = percentage of stomachs containing a particular prey/total number of investigated stomachs), prey types and food niches overlapping.

[1] „Al.I. Cuza" University of Iasi
[2] University of Camerino, Italy

Results and discussions

In the 143 individuals investigated there were found 1263 preys belonging to 77 taxa (Tab. 1).

Consumed preys were from both aquatic and terrestrial environments. Insects were dominant in all three species. Thus, in *Bufo viridis* 95.25% of preys were insects, suited by arachnids, 2%. In *Pelobates fuscus*, insects represented 74.19%, arachnids 16.12%. In *Rana esculenta* complex, 82.52% were insects while 10.22% crustaceans.

Best-represented order of insects was Hymenoptera for species *Bufo viridis* with 67.37% of the total insects, Coleoptera in *Pelobates fuscus*, with 43.47%, while in *Rana esculenta* complex, Diptera represented 58.55%.

Table 1 Food spectrum of *Bufo viridis, Pelobates fuscus* and *Rana esculenta* complex

No.	Taxa	Species								
		Bufo viridis			*Pelobates fuscus*			*Rana esculenta* complex		
		Indiv .no.	Ar %	F%	Indiv. no.	Ar %	F%	Indiv. no.	Ar %	F%
1	**Nemathelmintes**	1	0.14	1.85						
2	**Oligochaeta**							6	1.11	1.36
3	Lumbriculidae	4	0.57	3.7				7	1.3	4.1
4	**Hirudinea**							1	018	1.36
5	**Gasteropoda**									
6	*Physa* sp.							1	0.18	1.36
7	Planorbidae	1	0.14	1.85						
8	**Arachnida**									
9	Araneida	14	2	25.9	5	16.1	33.3	8	1.48	8.2
10	**Crustacea**									
11	Ostracoda	3	0.43	5.5				19	3.53	9.6
12	Cladocera	1	0.14	1.85						
13	*Chidorus* sp.							2	0.37	
14	*Alona* sp.							1	0.18	1.36
15	Copepoda	2	0.28	3.7				1	0.18	1.36
16	Isopoda	3	0.43	3.7	1	3.2	6.6	1	0.18	1.36
17	*Asellus* sp.	1	0.14	1.85				2	0.37	2.7
18	Amfipoda	2	0.28	1.85				1	0.18	1.36
19	Gammaridae							28	5.2	2.7
20	**Miriapoda**									
21	Julidae	1	0.14	1.85						
22	**Insecta**									
23	Undetermine	2	0.28	3.7				4	0.74	5.5
24	**Collembola**									

No.	Taxa	Species								
		Bufo viridis			*Pelobates fuscus*			*Rana esculenta* complex		
		Indiv .no.	Ar %	F%	Indiv. no.	Ar %	F%	Indiv. no.	Ar %	F%
25	*Podura aquatica*	1	0.14	1.85	5	16.1	6.6	89	16.57	5.5
26	*Isotoma* sp.	3	0.43	5.5						
27	*Sminthurides* sp.							1	0.18	1.36
28	**Ephemeroptera**									
29	*Cloëon* sp.	1	0.14	1.85						
30	**Odonata**				1	3.2	6.6			
31	**Heteroptera**									
32	*Nepa rubra*				1	3.2	6.6	2	0.37	2.7
33	*Ranatra linearis*				1	3.2	6.6			
34	*Pyrochoris apterus*	1	0.14	1.85						
35	*Hidrometra* sp.							1	0.18	1.36
36	*Sigara* sp.							1	0.18	1.36
37	*Micronecta* sp. (larvae)	1	0.14	1.85						
38	**Homoptera**									
39	Aphida	4	0.57	1.85	1	3.2	6.6	9	1.67	6.8
40	Cicade				2	6.45	6.6	1	0.18	1.36
41	**Coleoptera**									
42	Larvae							3	0.5	1.36
43	Adults	7	1	11.1	1	3.2	6.6	3	0.5	4.1
44	Carabidae	33	4.74	33.3	4	13	26.6	15	2.79	10.9
45	*Zabrus tenebrioides*	7	1	11.1				2	0.37	2.7
46	Curculionida	3	0.43	5.5				7	1.3	9.6
47	Chrysomellidae	2	0.28	3.7				3	0.5	4.1
48	*Gastroidea cyanea* (larvae)	2	0.28	3.7	1	3.2	6.6			
49	Hydrophillidae (larvae)							5	0.93	4.1
50	*Enochrus* sp.(larvae)							5	0.93	2.7
51	*Octhebius impressus* (larvae)				1	3.2	6.6			
52	Helodidae (larvae) *Scirtes tibialis*							2	0.37	2.7
53	Haliplidae (larvae) *Brychius* sp.							4	0.74	1.36
54	Staphylinidae	3	0.43	5.5	1	3.2	6.6	1	0.18	1.36

No.	Taxa	Species								
		Bufo viridis			*Pelobates fuscus*			*Rana esculenta* complex		
		Indiv .no.	Ar %	F%	Indiv. no.	Ar %	F%	Indiv. no.	Ar %	F%
55	Cantharide	1	0.14	1.85	1	3.2	6.6			
56	Elateridae	2	0.28	3.7						
57	Scarabeidae	2	0.28	3.7				1	0.18	1.36
58	Dytiscidae							1	0.18	1.36
59	*Melodema* sp.	1	0.14	1.85						
60	*Laccobius* sp.							1	0.18	1.36
61	**Diptera**									
62	Nematocera adults	21	3.02	7.4	1	3.2	6.6	32	5.9	24.6
63	pupae	1	0.14	1.85				1	0.18	1.36
64	Chironomidae									
65	larvae	11	1.58	11.1				6	1.11	8.2
66	adults	9	1.3	5.5				1	0.18	1.36
67	*Chironomus tricolor*	87	12.5	20.4				125	23.3	35.6
68	Ceratopogoninae larvae							2	0.37	2.7
69	nymphs *Bezzia* sp.							1	0.18	1.36
70	Stratiomyidae (larvae)	1	0.14	1.85				2	0.37	2.7
71	*Eulalia cincta* (larvae)	1	0.14	1.85						
72	Tabanidae *Tabanus* sp.	1	0.14	1.85						
73	Limoniidae (larvae)	1	0.14	1.85						
74	Psychodidae (larvae)	1	0.14	1.85				78	14.52	8.2
75	Psychodidae (nymphs)	1	0.14	1.85				1	0.18	1.36
76	Dolichopodidae							1	0.18	1.36
77	Tipulidae *Tipula* sp.							1	0.18	1.36
78	Culicidae *Orthopodomyia* sp.							1	0.18	1.36
79	Brachycera adults	1	0.14	1.85	1	3.2	6.6	8	1.48	8.21
80	**Hymenoptera**									
81	Adults	2	0.28	3.7						
82	Apidae				1	3.2	6.6	1	0.18	1.36
83	**Formicidae**	448	64.5	35.2				22		9.6

No.	Taxa	Species								
		Bufo viridis			*Pelobates fuscus*			*Rana esculenta* complex		
		Indiv .no.	Ar %	F%	Indiv. no.	Ar %	F%	Indiv. no.	Ar %	F%
84	Unidentified macroinvertebrates				2	6.45	13.3	3	0.5	4.1
85	*Bufo viridis* (tadpoles)							1	0.18	1.36
86	*Rana* sp. (juveniles)							12	2.2	4.1
	Prey totals **1263**	**695**			**31**			**538**		

A previous study regarding the food of species *Rana ridibunda* from Lake Ciric (Vancea et al., 1960) shows that dominant were coleopterans (31.25%) and dipterans (27.91%). In *Rana esculenta* complex, 5% from individuals presented the phenomenon of cannibalism, as demonstrated by the high number of juveniles and tadpoles identified in the stomachs. An analysis of stomachs total number shows that the highest number of empty stomachs was recorded in *Bufo viridis*. About half of each species' individuals presented plants in the stomach content while most specimens of *Pelobates fuscus* had solid materials (sand, pebbles), explainable by the life cycle of the species (Tab. 2).

Table 2 Comparative analysis of stomach contents of the three anuran species

Species	**No. of analysed stomachs**	**Stomachs without content**		**Stomachs with plants**		**Stomachs with solid materials**	
		No.	**%**	**No.**	**%**	**No.**	**%**
Bufo viridis	55	12	8.4	34	23.7	17	11.8
Pelobates fuscus	15	6	4.2	7	4.9	8	5.6
Rana esculenta complex	73	10	6.9	38	26.5	18	12.5
Totals	**143**	**28**	**19.58**	**79**	**55.24**	**43**	**30.07**

Food in *Bufo viridis* is less studied compared to the other species investigated. This is the first study regarding *Bufo*'s diet in Romania so far. The most abundant preys were hymenopterans (64%), followed by dipterans (20%) and coleopterans (9%) (Fig.1). We didn't observe significant differences between the feeding ways of males and females during the breeding period. 21.81% of the individuals presented empty stomachs.

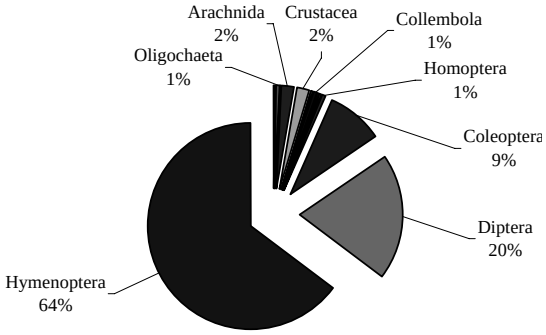


Fig. 1 Abundance spectrum of preys in *Bufo viridis*

Diet composition in *Pelobates fuscus* was recently studied in Romania. In the species' activity period, pulmonates (19.2%) and formicides (18.7%) are dominant (Cogalniceanu et al., 1998; Cogalniceanu et al., 2000). We found that during the breeding period coleopterans are dominant (30%), followed by arachnids (17%) and collemboles (16%) (Fig. 2). *Pelobates fuscus* is a species actively looking for food as demonstrated by the number of preys with high mobility (coleopterans and arachnids) and isolate distribution in environment (Cogalniceanu et al., 1998).

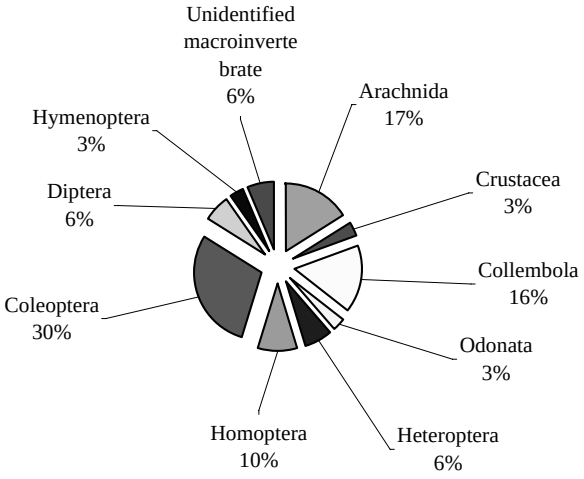


Fig. 2 Abundance spectrum of preys in *Pelobates fuscus*

Rana esculenta complex's diet was very well studied at international (Ratajsky F. et al., 1971, Chiminello A., Generani M., 1992 etc.) and national level (Sin Gh. et al., 1975, Valenciuc N. et al., 1986, Ghira I. et al., 1997, Cogălniceanu D., et al., 2000) (Tab. 3). Locally, Vancea Ştefan. and collaborators studied the food of species *Rana ridibunda* from the Lake Ciric in 1960 (Vancea Ştefan. et al., 1961). In the breeding period we observed the dominance of dipterans in the food of the species (49%), suited by collemboles (17%), coleopterans (10%) and crustaceans (10%). From literature (Tab. 2) we can see that dipterans and coleopterans are the most abundant preys (Fig. 3).

Table 3 Macroinvertebrates' dominance in food spectre of *Rana esculenta* complex

Vancea Ştefan. et al., 1960	Coleoptera 31.25% Diptera 27.94%
Sin Gh. et al., 1975	Homoptera 29.15% Diptera 23.6% Amphibia 8.61%
Valenciuc N. Ion I., 1986	Diptera 30.08% Coleoptera 22.66%
Chiminello A., Generani M., 1992	Hymenoptera 16.45% Coleoptera 16.45%
Ghira I. et al., 1997	Izopoda 25% Diptera 10.38%
Cogălniceanu et al., 2000	Coleoptera 24.4% Diptera 13.1%

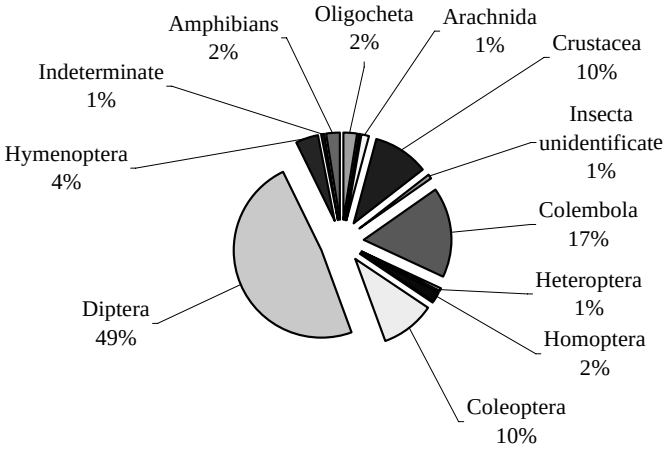


Fig. 3 Abundance spectrum of preys in *Rana esculenta* complex

It is known that reproduction of the investigated species takes place in the water, but it was observed that preys were terrestrial too. Thus, in *Pelobates fuscus*, terrestrial preys were dominant (66%) (Fig. 5) while the aquatic ones in *Rana esculenta* complex (55%), with a slow difference between the two types of prey (Fig. 6). Most of the preys in *Bufo viridis* diet were terrestrial (94%) (Fig. 4).

Fig. 4 Prey types dominance in *Bufo viridis*

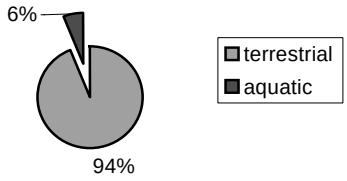


Fig. 5 Prey types dominance in *Pelobates fuscus*

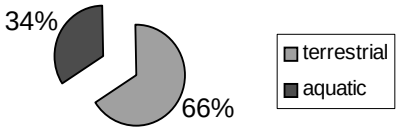
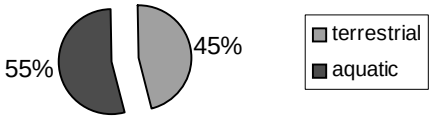


Fig. 6 Prey types dominance in *Rana esculenta* complex



Food niches overlapping showed the following situation:

- *Bufo viridis – Pelobates fuscus* 22.0%
- *Bufo viridis –Rana esculenta* complex 36.61%
- *Pelobates fuscus* - *Rana esculenta* complex 22.03%
- *Bufo viridis – Pelobates fuscus* - *Rana esculenta* complex 13.84%

Conclusions

In the food of *Bufo viridis* was recorded the dominance of the terrestrial species (94%), showing prey selectivity, as demonstrated by the high percentage of Formicidae (65%) found in the stomachs.

Dominance of the terrestrial coleopterans was observed in the diet of *Pelobates fuscus*.

Data from *Rana esculenta* complex showed a balanced feeding with preys from both aquatic and terrestrial environments. We also noticed the phenomenon of cannibalism.

Although the three species occupied the same microhabitats during the breeding period, with a temporal overlapping in *Bufo viridis* and *Pelobates fuscus* as well, we only found an overlapping of food niches of 13.84%.

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