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Food Composition of a *Pelophylax ridibundus* (Amphibia) Population From a Thermal Habitat in Banat Region (Southwestern Romania)

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Abstract: The food of *Pelophylax ridibundus* population from the thermal habitat from Carpinis presents great differences depending on the period. The feeding of frogs was more reduced throughout the winter, due to low temperatures, but also during autumn, due to the drought. Although the basic lines set by the previous studies on the feeding of amphibians in thermal waters are being followed, the facts here show more nuanced reality. Thus, not just low temperatures, but also other meteorological factors (drought or heavy rains) can induce important modifications in the feeding of amphibians. The feeding of *P. ridibundus* population was affected by the variation of such meteorological conditions throughout the entire year of our study. The trophic offer of the habitat was rather reduced, but the terrestrial environment had plenty of preys for the population to feed accordingly. Thus, the number of prey taxa was high, but also very variable among the study periods.

Key words: thermal water, trophic spectrum, marsh frog, environmental influence

Introduction

Due to the fact that the diversity of the amphibian's feeding is correlated with the quality of habitats (Kovács *et al.* 2007), the differences among their feeding between various habitats are usually important (Hirai & Matsui 2000, Bisa *et al.* 2007, Covaciu-Marcov *et al.* 2010a, Ferenti *et al.* 2010, Çiçek 2011). For amphibians, thermal waters from Western Romania are special habitats, where they stay active all along winter because of water high temperatures (Covaciu-Marcov *et al.* 2003, 2006, 2010b, 2011, Sas *et al.* 2007, Bogdan *et al.* 2011). Although most of the thermal habitats are in Northwestern Romania, thermal habitats with active amphibians during the winter were recently pointed out in the south-western part of the country as well, more specifically in Banat region (Covaciu-Marcov *et al.* 2010b, Bogdan *et al.* 2011). Past studies looked after the particularities of the populations from thermal waters and their feeding. Studies regarding feeding are relatively old and were carried out only in Northwestern Romania (Covaciu-Marcov *et al.* 2004, 2005a, b, 2006, Sas *et al.* 2004). They demonstrated that the feeding of the populations from thermal waters is strongly reduced during winter (Covaciu-Marcov *et al.* 2006). New knowledge regarding the feeding of the marsh frog from regular habitats was acquired in the past few years (Çiçek & Mermer 2006, Mollov 2008, Mollov *et al.* 2010, Paunović *et al.* 2010, Cicort-Lucaciu *et al.* 2011). Thus, we set out to study a *Pelophylax ridibundus* population from a recently identified thermal habitat, from a region where such studies were not carried out before.

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Material and Methods

The samples were taken monthly, between October 2010 and September 2011. In total, we analyzed 364 *P. ridibundus* specimens, each month their number being roughly around 30 (Table 1). The habitat is located close to the village of Carpinis, in Timis County (Covaciu-Marcov *et al*. 2010b). It consists of a canal some hundred meters long, filled by a high-flowing thermal water well. The canal varies in width, generally being 0.5 m wide, but can sometimes reach 1.5 m. Right around the well, the water presents only green algae, but farther along there are plenty of reeds both in and around the water. Its temperature exceeds 30 °C (Covaciu-Marcov *et al*. 2010b). The sector of the ditch where the frogs are active throughout winter is more than 200 m long. The canal is surrounded by agricultural fields cultivated with corn. Despite the fact that they start only at about 1-2 m from the water, the vegetation on the banks is extremely abundant.

The frogs were captured using round nets and were stocked in water buckets, which were kept partially submerged in the warm waters if the outside temperature was low. The stomach contents were sampled using the stomach-flushing method (Solé *et al*. 2005). In the end, the frogs were set free in the area of the canal where they were captured from. The stomach contents were stored in test tubes, conserved with formalin and determined in the laboratory. The data was analyzed statistically, calculating the percentage abundance (% A), frequency of occurrence (% f), the environment of origin for the preys and the average and maximum number of preys/individual. Dietary diversity was estimated with Shannon-Wiener (1949) diversity index (*H*). The Kruskal-Wallis test (Zar 1999) was calculated in order to establish if there are significant differences among the months of study. The trophic niche overlap among the study months was determined with Pianka test (Pianka 1973).

Results

Not all the frogs had stomach content. The highest frequency of empty stomachs was recorded in December (31.03%). Unfed frogs were documented only in winter, in October – February interval (Table 1). The amphibians presented four types of stomach contents: vegetal remains, shed skin fragments, inorganic elements and animal preys. Inorganic elements were ingested only in 8 months whereas vegetal remains and shed skin were consumed regularly. These stomach contents had different consumption frequencies among the months of study (Table 1).

Table 1. The frequency of occurrence of empty stomachs, vegetal parts, shed-skin and mineral parts (T-Total).

Year	2010			2011									T
Month	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Empty	6.25	3.23	31.03	6.45	3.23	-	-	-	-	-	-	-	4.12
Vegetal parts	68.75	80.65	41.38	67.74	70.97	62.50	71.88	88.89	66.67	79.31	82.76	80.65	71.70
Shed-skin	15.63	22.58	13.79	29.03	35.48	34.38	3.13	14.81	6.67	41.38	44.83	61.29	26.92
Mineral parts	6.25	12.90	-	-	3.23	-	12.50	-	3.33	3.45	6.90	3.23	4.40

Table 2. The number of the studied individuals, the feeding intensity and the origin of the consumed preys (T – Total).

Year	2010			2011									T
Month	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
No. of frogs	32	31	29	31	31	32	32	27	30	29	29	31	364
No. of preys	186	338	64	110	80	264	449	432	392	147	137	127	2726
Medium no. of preys	5.81	10.90	2.21	3.55	2.58	8.25	14.03	16.00	13.07	5.07	4.72	4.10	7.49
Maximum no. of preys / individual	11	93	3	5	16	33	13	38	48	4	7	7	93
% of aquatic preys	2.15	2.07	15.63	7.27	28.75	5.30	3.79	3.70	20.15	0.68	2.92	0.79	6.75
% of terrestrial preys	97.85	97.93	84.38	92.73	71.25	94.70	96.21	96.30	79.85	99.32	97.08	99.21	93.25

A total number of 2726 preys were consumed throughout the year. Their number varies depending on the period, but the smallest values were recorded during winter, in December only 64 preys being consumed (Table 2). The same situation is recorded for the maximum and average numbers of preys/individual, which also have low values during the winter (Table 2). The highest value for the maximum number of preys/individual was recorded in November, but it is a consequence of the consumption of very small preys such as Aphids (Table 3). The highest values for the average number of preys/individual were documented in spring, in April, May and June (Table 2). Overall, the percentage of terrestrial preys was over 90%. The amounts of preys captured from the terrestrial and aquatic environments differ a lot in the various periods (Table 2).

The animal preys belonged to 49 prey taxa, out of which only 5 were consumed throughout all the 12 months (Araneida, Heteroptera, Coleoptera, Nematocera and Formicida). The number and type of consumed prey taxa differ a lot among the months (Table 3). The highest number of prey taxa was consumed during spring and in the beginning of summer while the smallest number was consumed during winter and at the end of summer. Generally, Coleoptera had the highest amount, followed by Nematocera and Aphida (Table 3). In terms of frequency, Coleoptera again had first place, but this time followed by spiders and then mosquitoes (Table 4). The amounts and frequencies of consumed prey taxa had significant modifications among periods (Table 3, 4).

The overlap of trophic niches indicates great differences among certain months (Fig. 1). There were months between which the niches overlapped a lot, the feeding being therefore similar, but also months between which the overlap was reduced, the niches being more different. Great overlaps of trophic niches exist between August and September, between April and May and also between December and the autumn months (Fig. 1). The differences of feeding between consecutive months are usually not significant. Significant differences occur between October and February, between the end of spring and the beginning of summer months and between the summer and autumn months (Table 5).

Discussion

Generally, the feeding of *P. ridibundus* population from Carpinis is similar to the feeding of other non-hibernating populations (Covaciu-Marcov *et al.* 2004, 2005a, b, 2006, Sas *et al.* 2004). In the case of those populations, it has been noted that their feeding is reduced during the winter, as air temperature modifies the trophic offer available from the terrestrial environment. Such an evolution can be observed at Carpinis, too. Although our study was done at almost 10 years since the previous researches, the factors that influence the feeding of non-hibernating populations remain the same. This is how only in the winter there are frogs with empty stomachs, their percentage being sometimes quite considerable. Furthermore, the number of prey taxa and the maximum and average number of preys/individual were also decreased during winter. In case of amphibians, individuals without food indicate the rarity of available trophic resources (Aszalós *et al.* 2005, Kovács *et al.* 2007).

However, despite the fact that the rules stated prior to our study are respected, certain differences do appear at Carpinis. Thus, January is an exception, all the followed parameters having higher values than in any other winter months, values sometimes resembling the warm season. This apparent elusion from the rule, followed by a comeback to normal in February, was a consequence of thermic particularities of sampling date in January 2011. In this interval, there was a short, yet important, warm-up period. During our sampling date, the temperature in the air was about 10 °C, similar to what occurred in March. This allowed the activity of a higher number of terrestrial preys, leading to the raise of the diversity in the frogs' diet. Unlike January, the feeding was more reduced in December and February. Significant differences appear between these two months and the months from late spring-early summer, when the amphibians` feeding was very intense. During December and February, the outside air temperatures were typical for winter, fact that affected the frogs' diet in the previously described way (Covaciu-Marcov *et al.* 2004, 2005b, 2006). Distinctly from them, January differs significantly only in comparison to June.

The most different feeding was recorded in February and April. Both months differs significantly from other 3 months. In addition, between them,

Table 3. The percentage abundance (%) and the diversity of the consumed preys (l.- larvae, aq.- aquatic, T – Total).

Year	**2010**			**2011**									**T**
Month	**X**	**XI**	**XII**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	
Oligocheta – Lumbricidae	1.20	1.34	1.72	5.88	1.32	0.54	31.51	7.07	-	0.75	-	-	7.01
Gasteropoda (snails)	4.82	5.37	10.34	-	2.63	0.54	4.43	9.69	3.11	16.54	-	-	5.12
Gasteropoda (snails) (aq.)	-	0.34	3.45	-	-	-	-	-	-	-	-	-	0.13
Gasteropoda (slug)	3.61	1.01	3.45	-	-	-	0.26	-	-	-	-	-	0.52
Aranea – Araneidae	4.22	2.35	18.97	9.41	1.32	4.30	4.17	5.76	9.63	22.56	21.60	20.72	8.21
Aranea – Acari	-	-	-	-	-	0.54	-	-	-	-	-	-	0.04
Aranea – Opilionida	-	-	-	-	-	-	-	-	0.31	-	-	-	0.04
Crustaceea – Cladocera (aq.)	-	-	-	-	21.05	-	-	-	-	-	-	-	0.69
Crustaceea – Amphipoda (aq.)	-	-	-	-	-	-	-	0.52	-	-	-	-	0.09
Crustaceea – Isopoda	1.20	0.67	1.72	-	3.95	1.61	0.26	0.79	0.93	3.76	2.40	1.80	1.20
Crustaceea – Isopoda (aq.)	-	-	-	-	-	-	-	-	-	-	0.80	-	0.04
Miriapoda – Chilopoda	-	-	-	1.18	1.32	-	0.26	0.79	-	-	-	-	0.26
Miriapoda – Diplopoda	0.60	-	-	3.53	-	0.54	-	0.26	-	-	-	-	0.26
Efemeroptera (l.)	-	-	-	-	-	-	0.26	-	0.31	-	-	-	0.09
Odonata (l.)	-	0.67	-	-	-	1.08	0.26	-	-	-	-	-	0.21
Odonata	-	-	-	-	-	1.08	-	-	2.48	-	0.80	-	0.47
Ortoptera	-	-	-	-	-	-	-	-	1.55	0.75	-	-	0.26
Heteroptera	8.43	1.01	1.72	5.88	-	1.61	2.34	0.79	2.80	6.77	6.40	5.41	3.01
Heteroptera (aq.)	-	0.34	-	2.35	5.26	3.76	1.04	0.52	3.11	0.75	-	-	1.33
Homoptera – Afidinae	5.42	60.74	-	14.12	-	-	-	-	-	-	-	-	8.68
Homoptera – Cicadellidae	16.27	-	-	1.18	-	8.06	-	0.52	7.14	-	-	-	2.92
Coleoptera (l.) – undet.	1.20	-	1.72	1.18	-	-	-	-	-	0.75	0.80	-	0.26
Coleoptera – Dytiscidae (l.) (aq.)	1.20	0.67	3.45	1.18	-	0.54	0.52	2.09	-	-	-	-	0.77
Coleoptera – Dytiscidae (aq.)	1.20	1.01	3.45	2.35	-	0.54	0.26	-	1.24	-	0.80	-	0.69
Coleoptera – undet.	7.23	11.74	8.62	11.76	3.95	10.75	1.82	1.57	5.59	3.76	0.80	5.41	5.50
Coleoptera – Cantaridae	-	-	-	-	-	-	-	-	1.24	-	-	-	0.17
Coleoptera – Carabidae	1.81	0.67	-	3.53	-	2.69	5.21	2.88	4.97	2.26	7.20	5.41	3.35
Coleoptera – Cerambicidae	-	-	-	-	-	-	1.04	1.05	-	-	-	-	0.34
Coleoptera – Coccinelidae	0.60	-	1.72	-	-	-	0.26	-	-	1.50	-	1.80	0.30
Coleoptera – Curculionidae	0.60	0.34	-	1.18	-	1.61	4.69	3.93	0.93	0.75	-	0.90	1.89
Coleoptera – Crysomelidae	-	-	-	-	-	-	0.26	-	2.80	2.26	-	0.90	0.60
Coleoptera – Elateridae	-	-	-	-	-	-	1.04	2.36	3.42	-	0.80	-	1.07
Coleoptera – Scarbeidae	-	-	-	4.71	1.32	26.34	2.34	0.79	2.17	-	0.80	-	3.18
Coleoptera – Stafilinidae	1.81	0.67	-	8.24	-	0.54	0.26	0.52	0.62	-	-	-	0.77
Lepidoptera (l.)	6.02	0.34	3.45	1.18	-	0.54	1.30	2.09	0.93	2.26	5.60	7.21	2.11
Lepidoptera	-	-	-	-	-	-	-	-	0.31	0.75	0.80	0.90	0.17
Trichoptera	-	-	-	-	1.32	-	-	-	-	-	-	-	0.04
Mecoptera	-	-	-	-	-	-	-	-	0.31	-	-	-	0.04
Diptera – Nematocera (l.)	-	-	1.72	2.35	2.63	-	1.56	-	18.63	-	-	-	3.05
Diptera – Nematocera – Cullicidae	10.84	4.36	3.45	4.71	44.74	14.52	26.82	45.29	1.24	3.76	1.60	1.80	16.64
Diptera – Nematocera – Tipulidae	-	-	-	-	-	-	-	5.50	-	-	-	0.90	0.95
Diptera – Brahicera (l.)	3.01	0.67	3.45	-	2.63	0.54	-	-	-	0.75	-	-	0.56
Diptera – Brahicera (l.) (aq.)	-	-	5.17	1.18	1.32	2.69	1.04	1.05	1.55	-	1.60	0.90	1.12
Diptera – Brahicera – Muscidae	9.04	2.68	18.97	4.71	3.95	4.30	2.34	0.26	9.01	16.54	27.20	35.14	7.87
Diptera – Brahicera – Tabanidae	-	-	-	-	-	-	-	-	1.86	0.75	-	-	0.30
Hymenoptera – undet.	4.22	-	-	5.88	-	2.15	-	0.26	-	2.26	0.80	0.90	0.95
Hymenoptera – Formicidae	5.42	2.68	3.45	2.35	1.32	8.06	4.43	3.66	11.80	9.77	17.60	9.01	6.49
Hymenoptera – Apidae	-	-	-	-	-	0.54	-	-	-	-	1.60	0.90	0.17
Anura – *R. ridibunda*	-	0.34	-	-	-	-	-	-	-	-	-	-	0.04
Shannon-Wiener Diversity Index (H)	2.78	1.62	2.58	2.84	1.91	2.53	2.24	2.17	2.81	2.41	2.15	2.09	3.35

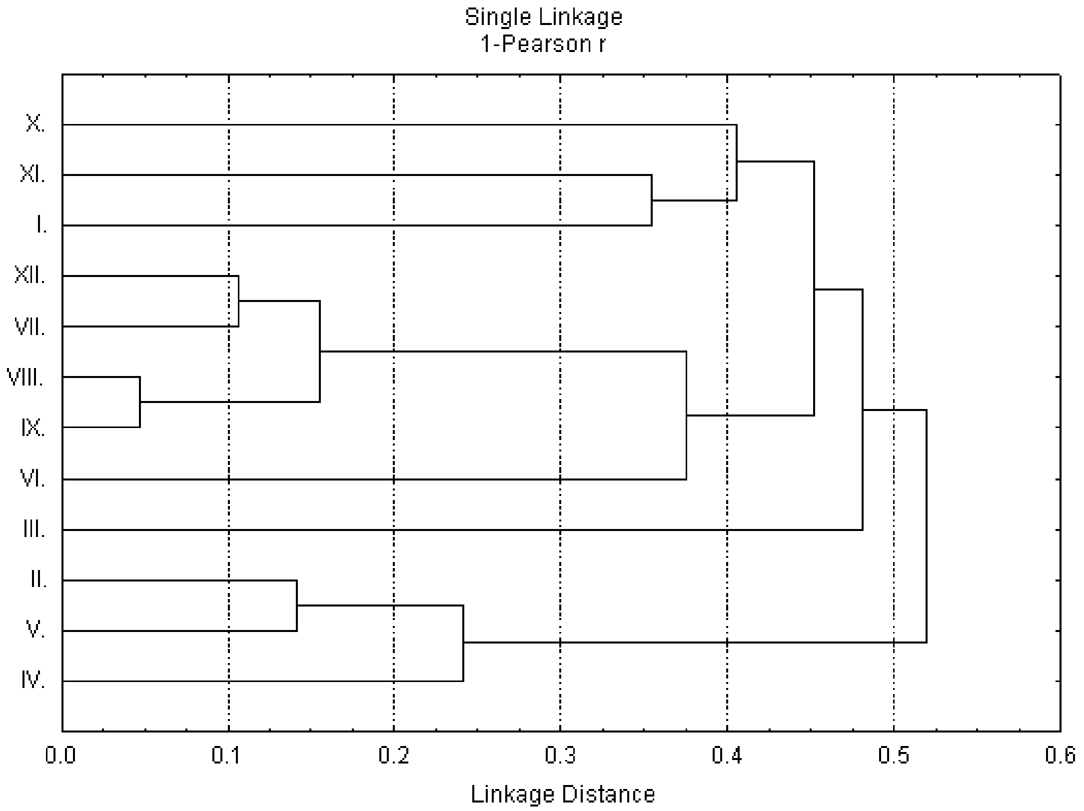

Fig. 1. Trophic niche overlap between different months of the study (Pianka index).

they have the most significant differences. During February the feeding was extremely reduced, this being a typically winter month. The biggest amount for aquatic preys was also recorded in February, as a compensation for the poor trophic offer available from terrestrial environment (Covaciu-Marcov *et al.* 2005b). In opposition, the feeding during April was intense, even though it was not the most intense. In April the significant difference comes from the fact that the feeding is focused on preys that are missing or are very rare during other months. This is how, in April, the earthworms occurred in high amounts. This is caused by a rainy period and work on the neighboring agricultural fields, which brought a lot of earthworms to the surface. Since those agricultural fields are very close to the water, the frogs could easily hunt them. Thus, not just the special conditions documented in winter, but also the accidental thermic particularities have induced major differences in the feeding of the frogs.

Alongside the differences between the feeding in winter and spring/summer, significant and almost significant differences appear between the summer and the autumn months. The difference between June and September is significant, while the differences between June and August and May and September are almost significant. Actually, they tend to be more and more significant as we compare summer to autumn months. Although smaller than the differences between summer and winter, the differences between summer and autumn are significant. In other cases a reduction in the feeding of frogs was recorded during summer, not autumn. This aspect is valid for thermal water populations (Covaciu-Marcov *et al.* 2005b), but also for other amphibians as well, feeding during autumn being intense (Kovács *et al.* 2007, Yu *et al.* 2009). However, at Carpinis things were different, because of the specific climatic features of the time frame, in Western Romania 2011 autumn being very dry. As such, in the months from late summer and early fall, trophic offer was greatly reduced due to the drought. Prey taxa linked to high humidity, such as earthworms or snails, disappeared from the diet of the frogs. Moreover, the number of consumed prey taxa has reduced in autumn. As such their number from September 2011 was smaller than that from October 2010 (17 to 23 respectively). This fact is also confirmed by the narrow overlap of trophic niche be-

Table 4. The frequency of occurrence of the consumed preys (l.- larvae, aq.- aquatic, T – Total).

Year	2010			2011									T
Month	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Oligocheta – Lumbricidae	6.25	9.68	3.45	9.68	3.23	3.13	81.25	29.63	-	3.45	-	-	12.64
Gasteropoda (snails)	18.75	29.03	10.34	-	3.23	3.13	31.25	59.26	10	37.93	-	-	16.48
Gasteropoda (snails) (aq.)	-	3.23	3.45	-	-	-	-	-	-	-	-	-	0.55
Gasteropoda (slug)	12.50	9.68	6.90	-	-	-	3.13	-	-	-	-	-	2.75
Aranea – Araneidae	21.88	22.58	27.59	19.35	3.23	25.00	34.38	44.44	53.33	68.97	55.17	45.16	34.62
Aranea – Acari	-	-	-	-	-	3.13	-	-	-	-	-	-	0.27
Aranea – Opilionida	-	-	-	-	-	-	-	-	3.33	-	-	-	0.27
Crustaceea – Cladocera (aq.)	-	-	-	-	3.23	-	-	-	-	-	-	-	0.27
Crustaceea – Amphipoda (aq.)	-	-	-	-	-	-	-	7.41	-	-	-	-	0.55
Crustaceea – Isopoda	6.25	6.45	3.45	-	9.68	9.38	3.13	11.11	10	10.34	10.34	6.45	7.14
Crustaceea – Isopoda (aq.)	-	-	-	-	-	-	-	-	-	-	3.45	-	0.27
Miriapoda – Chilopoda	-	-	-	3.23	3.23	-	3.13	11.11	-	-	-	-	1.65
Miriapoda – Diplopoda	3.13	-	-	6.45	-	3.13	-	3.70	-	-	-	-	1.37
Efemeroptera (l.)	-	-	-	-	-	-	3.13	-	3.33	-	-	-	0.55
Odonata (l.)	-	3.23	-	-	-	6.25	3.13	-	-	-	-	-	1.10
Odonata	-	-	-	-	-	3.13	-	-	16.67	-	3.45	-	1.92
Ortoptera	-	-	-	-	-	-	-	-	13.33	3.45	-	-	1.37
Heteroptera	28.13	6.45	3.45	16.13	-	9.38	21.88	11.11	20	24.14	27.59	9.68	14.84
Heteroptera (q.)	-	3.23	-	6.45	9.68	12.50	12.50	7.41	10	3.45	-	-	5.49
Homoptera – Afidinae	15.63	22.58	-	22.58	-	-	-	-	-	-	-	-	5.22
Homoptera – Cicadellidae	34.38	-	-	3.23	-	25.00	-	7.41	30	-	-	-	8.52
Coleoptera (l.) – undet.	6.25	-	3.45	3.23	-	-	-	-	-	3.45	3.45	-	1.65
Coleoptera – Dytiscidae (l.) (aq.)	6.25	6.45	3.45	3.23	-	3.13	6.25	22.22	-	-	-	-	4.12
Coleoptera – Dytiscidae (aq.)	6.25	6.45	6.90	6.45	-	3.13	3.13	-	13.33	-	3.45	-	4.12
Coleoptera – undet.	28.13	45.16	10.34	29.03	9.68	34.38	18.75	14.81	40	17.24	3.45	19.35	22.80
Coleoptera – Cantaridae	-	-	-	-	-	-	-	-	10	-	-	-	0.82
Coleoptera – Carabidae	9.38	6.45	-	3.23	-	12.50	40.63	25.93	36.67	10.34	17.24	16.13	14.84
Coleoptera – Cerambicidae	-	-	-	-	-	-	9.38	11.11	-	-	-	-	1.65
Coleoptera – Coccinelidae	3.13	-	3.45	-	-	-	3.13	-	-	6.90	-	6.45	1.92
Coleoptera – Curculionidae	3.13	3.23	-	3.23	-	3.13	31.25	40.74	10	3.45	-	3.23	8.24
Coleoptera – Crysomelidae	-	-	-	-	-	-	3.13	-	23.33	10.34	-	3.23	3.30
Coleoptera – Elateridae	-	-	-	-	-	-	12.50	29.63	30	-	3.45	-	6.04
Coleoptera – Scarbeidae	-	-	-	9.68	3.23	25.00	21.88	11.11	23.33	-	3.45	-	8.24
Coleoptera – Stafilinidae	9.38	6.45	-	22.58	-	3.13	3.13	7.41	6.67	-	-	-	4.95
Lepidoptera (l.)	15.63	3.23	6.90	3.23	-	3.13	12.50	22.22	6.67	10.34	17.24	25.81	10.44
Lepidoptera	-	-	-	-	-	-	-	-	3.33	3.45	3.45	3.23	1.10
Trichoptera	-	-	-	-	3.23	-	-	-	-	-	-	-	0.27
Mecoptera	-	-	-	-	-	-	-	-	3.33	-	-	-	0.27
Diptera – Nematocera (l.)	-	-	3.45	6.45	3.23	-	3.13	-	10	-	-	-	2.20
Diptera – Nematocera – Cullicidae	34.38	19.35	6.90	12.90	48.39	31.25	78.13	81.48	10	13.79	6.90	6.45	29.12
Diptera – Nematocera – Tipulidae	-	-	-	-	-	-	-	44.44	-	-	-	3.23	3.57
Diptera – Brahicera (l.)	15.63	6.45	3.45	-	6.45	3.13	-	-	-	3.45	-	-	3.30
Diptera – Brahicera (l.) (aq.)	-	-	10.34	3.23	3.23	15.63	12.50	14.81	16.67	-	6.90	3.23	7.14
Diptera – Brahicera – Muscidae	34.38	19.35	20.69	6.45	9.68	21.88	15.63	3.70	50	34.48	62.07	51.61	27.47
Diptera – Brahicera – Tabanidae	-	-	-	-	-	-	-	-	13.33	3.45	-	-	1.37
Hymenoptera – undet.	21.88	-	-	9.68	-	12.50	-	3.70	-	6.90	3.45	3.23	5.22
Hymenoptera – Formicidae	18.75	16.13	3.45	6.45	3.23	25.00	25.00	33.33	53.33	34.48	31.03	16.13	21.98
Hymenoptera – Apidae	-	-	-	-	-	3.13	-	-	-	-	6.90	3.23	1.10
Anura – *R. ridibunda*	-	3.23	-	-	-	-	-	-	-	-	-	-	0.27

Table 5. The significance of the differences between the month of the study (Kruskal-Wallis test, p level).

Month	**X**	**XI**	**XII**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**
X	1	0.723	0.116	0.582	0.047	0.744	0.766	0.606	0.312	0.513	0.252	0.162
XI		1	0.424	0.874	0.101	0.992	0.557	0.265	0.082	0.965	0.604	0.255
XII			1	0.536	0.317	0.324	0.105	0.030	0.021	0.452	0.807	0.675
I				1	0.128	0.929	0.458	0.186	0.046	0.876	0.710	0.305
II					1	0.175	0.045	0.013	0.001	0.107	0.270	0.720
III						1	0.534	0.446	0.171	0.861	0.488	0.310
IV							1	0.902	0.498	0.401	0.194	0.109
V								1	0.796	0.195	0.089	0.055
VI									1	0.160	0.055	0.010
VII										1	0.645	0.307
VIII											1	0.522
IX												1

tween those months. Additionally, the consumption of shed skin and vegetal material has also risen during autumn, reaching higher frequency values even than in the winter. This aspect is important as it has been observed, for other amphibians, that the consumption of shed skin appears when the feeding is poor, being an upshot of a reduced trophic offer (Cicort-Lucaciu *et al*. 2005, Kovács *et al*. 2010). However shed-skin was consumed in summer by amphibians that feed properly (Ferenti & Covaciu-Marcov 2011)

The reduction of feeding during autumn is the second particularity of the population from Carpinis. Besides, the amount of aquatic preys has also dropped during autumn, which could have partially compensated for the reduced offer due to the drought. This fact is partially a consequence of the massive growth of the surrounding terrestrial vegetation that covered the surface of the water in areas where the canal is narrower. In the wider areas, water level dropped massively, or even dried out completely. These results show the importance of meteorological conditions on the feeding of amphibians and how much the feeding can differ in terms of habitat or between years. Although the conditions from thermal waters seem stabile because of constant water temperature, they are still exposed to the influence of general climate. The water conditions are stabile, but amphibians depend on the trophic offer of terrestrial environment and this, in turn, is modified by meteorological changes. It was previously suggested that the temperature can be an important limiting factor of a feeding activity (Yu *et al*. 2009).

P. ridibundus generally consumes terrestrial preys (Çiçek & Mermer 2006, Mollov 2008, Cicort-Lucaciu *et al*. 2011), relying on the conditions from terrestrial environment surrounding the habitat. The seasonal differences of the amounts and frequencies of consumed prey taxa are primarily a result of the seasonal modifications of the environment conditions that ultimately changed frogs' accessibility to those particular prey taxa. An obvious proof for this is the case of earthworms. However, seasonal differences were not noted for the feeding of all amphibians (Ferreira & Teixeira 2009). Such variations do not occur for species from tropical regions, that feed on preys constantly abundant (Ferreira & Teixeira 2009). In other cases, seasonal modifications of the feeding are evident (e.g. Houston 1973, Ao *et al*. 2001, Kovács *et al*. 2007, Sas *et al*. 2009).

The trophic offer of the aquatic habitat from Carpinis is poor, an obvious fact if we look at the low amount of aquatic preys in the frogs' diet. The habitat is an artificial one and thus, frogs' feed mostly on terrestrial preys just like they do in other artificial habitats (Cicort-Lucaciu *et al*. 2011). If the aquatic habitat is favourable, the frogs do consume many aquatic preys during winter (Covaciu-Marcov *et al*. 2005b, 2006), but this does not happen here. However, although it is artificial and surrounded by agricultural field, the neighboring terrestrial habitat presents a trophic offer that's sufficient for the studied population, a fact proven by the numerous terrestrial prey taxa consumed. In this context, the main role is that of the vegetation girdle that borders the water and a secondary role is held by the agricultural fields. Still, preys like the terrestrial Heteroptera had most likely come from the agricultural fields. The only vertebrate consumed, in November, was a *P. ridibundus* juvenile, however in other cases the consumption of vertebrates is known to be more important for this species (Çiçek & Mermer 2006, Mollov 2008). This is probably a consequence of the reduced offer of thermal canal and the existence of sufficient terrestrial preys.

The results of this study modulate the previously stated rules regarding the feeding of *P. ridibundus* populations form thermal waters during winter. Thus, we bring out the special importance of the habitat and of the general meteorological conditions on the frogs' diet. Weather conditions generally affect the feeding. So, not just the low temperatures during winter but also the drought have a negative effect on the feeding. The feeding of the population from Carpinis confirms that the fluctuations in time of the feeding of amphibians are linked with the meteorological conditions, with rain and with the air temperature (Cogalniceanu *et al.* 1998). Since the habitat is artificial, the trophic offer available for the frogs come from the surrounding terrestrial habitat, which is in turn anthropogenically affected and depends on climate conditions (cold, drought, rain). Drought has the same effect as the cold, shrinking the trophic offer available to frogs and hence reducing the feeding. These results raise question marks referring to the possible influence of the climate changes on the feeding of amphibians, the influence of climate changes on biodiversity being a very actual subject (Kapelle *et al.* 1999, Botkin *et al.* 2007, Heller & Zavaleta 2009, Kannan & James 2009). Our results show how much annual meteorological variations can influence the feeding of a common species from Romania, such as *P. ridibundus* (Cogalniceanu *et al.* 2000).

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