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Data on food composition of the Levant marsh frog (*Pelophylax bedriagae*) in Southwestern Anatolia

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Abstract. The food composition of *Pelophylax bedriagae* was studied in the province of Muğla, southwestern Anatolia. The food contents of 32 individuals (16 males, 16 females) were collected by using the stomach-flushing method. A total of 128 different food items were detected and identified to the lowest possible taxa. Class Insecta was the most dominant prey category, 60% in number, 87% in frequency and 33% in volume. Among orders, Diptera was the highest prey group in both number (27%) and frequency (53%) whereas Coleoptera was the highest in volume (17%). Similarly, Culicidae was the highest prey group in both number (20%) and frequency (33%) among families while Scarabaeidae was the highest in volume (17%). There was no difference between the number of preys consumed by females and males.

Key words: Amphibia, Ranidae, feeding biology, diet, stomach flushing, Turkey.

Introduction

Approximately one-third of all amphibian species in the world are categorized under threat (AmphibiaWeb 2021). The main reason for the numerical decrease of amphibians is the destruction of freshwater habitats caused by degradation of wetlands, pollution, climate change and animal diseases. Decrease and/or extinction of amphibians is clear evidence of the harmful effects of humans on natural ecosystems (Halliday 2008). Understanding the reasons for decreasing amphibian populations worldwide requires detailed research on their ecological role in ecosystems. To this aim, feeding biology is one of the first aspects that must be investigated to fully understand the ecology of a species (Hirschfeld & Rödel 2011). Amphibians are generally carnivores and they feed on various vertebrate or invertebrate animals (Duellman & Trueb 1986). They are usually opportunistic predators (Duellman & Trueb 1986, Sugai et al. 2012) that usually prey on pests and their larvae. In this way, they play an important role in preventing agricultural economic losses by contributing to biological balance and protection of agricultural plants. This underlines the important role of amphibians in biological control of insects (Yiyit et al. 1999, Çiçek & Mermer 2006, Pesarakloo et al. 2017). One of the main benefits of studying amphibians' feeding habits is to acquire knowledge to assess the most suitable habitats for them (Gunzburger 1999). Information about the diet of a species can also help develop protection and conservation strategies (Camera et al. 2014).

Until today, many researchers have carried out studies on the feeding habits of the ranid species in Anatolia (Atatür et al. 1993, Çiçek & Mermer 2006, Çiçek & Mermer 2007, Çiçek 2011). However, there is still a lack of information on the diet of the Southwestern Anatolian populations. The objective of the present study was to collect detailed information on the feeding habits of the Levant marsh frog (*Pelophylax bedriagae*) in Southwestern Anatolia.

Materials and Methods

The study site is located in the Lake Kocagöl within the borders of Kapukargın Village, which is 6 km away from Dalaman town in the province of Muğla [Lat. = 36.68854°, Long.= 28.826636°, 0 m a.s.l.]. Frogs were captured by hand between 22:00 to 00:00 hours in June and August 2018. The sex of each individual was determined by the presence of vocal sacs and vocal slits in males and their absence in females (Başoğlu et al. 1994). Then, snout-vent length (distance from the tip of the snout to the cloaca, SVL) was measured using a calliper to the nearest 0.1 mm. Within an hour following capture, their stomach contents were collected in the field by flushing the stomach with pressurized water (Hirai & Matsui 1999). The food items were preserved in 70% alcohol for subsequent analysis. All captured frogs were released in their environment within one hour. Food items were identified to the lowest possible taxa. After the identification of nutrients from the stomach, the lengths (L) and widths (W) of the prey were calculated with the help of a graph paper on the microscope. Prey numbers in the stomach (n), percentage of prey (% n), frequency (f), percentage of frequency (% f), volume (V) and percentage of volume (V%) were calculated. The prey length and width were measured, and the prey volume was calculated using ellipsoid formula (Dunham 1983): $V = 4/3\pi\ (L/2)\ (W/2)^2$ (V: prey volume; L: length of prey; W: width of prey). To determine the relative importance of each prey category in the diet of the species, the Index of Relative Importance (IRI) (Hart et al. 2002) was calculated using the following formula: $IRI = (N\% + V\%)\ F\ \%$, where N% is the numerical proportion of each prey in the diet; V% is the volumetric proportion of each prey in the diet; F% is the relative frequency of occurrence of prey.

The SPSS Statistical Program (vers. 22.0) was used for the statistical analyses of the data. Mann-Whitney U test was used to compare the difference between prey numbers, lengths, and prey volumes of male and female individuals. The relationship between SVL, number of food and prey volume of *P. bedriagae* specimens was investigated by calculating Kendall's correlation coefficient (tau_b). All the analyses were made and evaluated at a 95% confidence interval (Zar 2009). $P < 0.05$ was considered statistically significant.

Results

Data from a total of 32 individuals (16 females, 16 males) were collected. Two females (6.25%) were found to have empty stomachs. The total number of consumed preys was 128. The total prey number found was 60 from the 14 females and 68 from the 16 males. The average prey number per stomach was found to be 4.27: 4.29 and 4.25 for females and males, respectively.

Small structures such as antennas, wings, and heads with unidentifiable single parts, which have been added only to total volume, have been omitted. The total prey volume was 17,653.08 mm³ (mean= 201.82, SD= 1,046.57). The total volume of the stomach content was 12,015.21 mm³ (mean = 187.73, SD = 493.37) for 14 females and 5.637.87 mm³ (mean = 68.75, SD = 231.99), for 16 male individuals. According to Mann-Whitney U test, there was a significant difference in total volume between male and female individuals (U test, Z = -3.603, $P < 0.05$). However, no significant difference was found between sexes in terms of consumed food amount (U test, Z = -0.358, P = 0.72).

The minimum SVL of females was 68.39 mm and the maximum distance was 95.73 mm (mean=80.59) while the same values were 65.84 mm and 77.69 mm (mean=72.01) for males respectively.

The diet of *P. bedriagae* consisted primarily of Arthropoda (Insecta, Arachnida, Chilopoda and Malacostraca), Mollusca (Gastropoda) and Annelida (Clitellata). According to the IRI, the most important taxa in the diet was Diptera (IRI = 1,555.41). Other important prey taxa were Hymenoptera (IRI = 1.174.30), Basommatophora (IRI = 991.13) and Araneae (IRI = 862.52). High values indicate high importance of the particular prey in the diet (Table 1).

Table 1. IRI and percentage rates of number, frequency, and volume of preys in the diet of *Pelophylax bedriage*.

Classis	n%	f%	V%	Order	n%	f%	V%	IRI	Familia	n%	f%	V%
Insecta	60.16	86.67	33.16	Homoptera	0.78	3.33	0.90	5.56	Delphacidae	0.78	3.33	0.89
				Hymenoptera	17.97	46.67	7.25	1174.30	Apidea	2.34	10.00	1.80
									Formicidae	10.94	23.33	1.64
									Vespidae	4.69	16.67	3.76
				Coleoptera	7.81	26.67	17.70	679.02	Cantharidae	0.78	3.33	0.09
									Carabidae	3.91	13.33	0.44
									Coccinellidae	1.56	6.67	0.04
									Elateridae	0.78	3.33	0.01
									Scarabaeidae	0.78	3.33	17.08
				Diptera	27.34	53.33	1.79	1555.41	Culicidae	19.53	33.33	1.54
									Muscidae	7.81	23.33	0.23
				Hemiptera	2.34	6.67	3.13	36.35	Cicadellidae	0.78	3.33	3.04
									Gerridae	0.78	3.33	0.05
									Nabidae	0.78	3.33	0.03
				Ephemeroptera	0.78	3.33	0.03	2.69	Ephemerllidae	0.78	3.33	0.03
				Heteroptera	2.34	10.00	0.50	28.41	Pentatomidae	2.34	10.00	0.50
				Odonata	0.78	3.33	2.01	9.2	Aeshnidae	0.78	3.33	2.00
Arachnida	10.16	36.67	13.37	Araneae	10.16	36.67	13.46	862.52	Araneidae	7.81	26.67	13.19
									Agelenidae	1.56	6.67	0.17
									Philodromidae	0.78	3.33	0.002
Gastropoda	17.97	40.00	6.81	Basommatophora	17.97	40.00	6.21	991.13	Lymnaeidae	13.28	30.00	5.30
									Planorbidae	4.69	20.00	1.51
Malacostraca	10.16	30.00	16.58	Amphipoda	7.81	23.33	12.48	471.36	Gammaridae	7.81	23.33	12.39
				Isopoda	1.56	6.67	0.19	11.68	Oniscidae	0.78	3.33	0.09
									Sphaeromatidae	0.78	3.33	0.09
				Decapoda	0.78	3.33	4.03	15.94	Palaemonidae	0.78	3.33	4.00
Chilopoda	0.78	3.33	10.67	Scolopendromorpho	0.78	3.33	10.75	38.17	Scolopendridae	0.78	3.33	10.67
Clitellata	0.78	3.33	0.67	Lumbriculida	0.78	3.33	0.67	4.82	Lumbriculidae	0.78	3.33	5.30

Class Insecta had the highest value in terms of numerical proportion (n= 60.16 %), frequency (f= 86.67 %) and volume (V= 33.16 %). In both females and males, Diptera was found to be the highest in frequency ($f_{females}$ = 64.29 %, f_{males} = 43.75 %) and numerical proportion ($n_{females}$ = 28.33 %, n_{males} = 26.47 %). However, due to the small volume ($V_{females}$ = 1.14 %, V_{males} = 3.24 %), insects were detected in very low rates (Table 2).

According to the Mann-Whitney U test, there was no difference in the prey numbers between male and female individuals. However, there was a significant difference in total volume between the males and the females. According to the results, it was concluded that females feed with larger prey and have the highest prey volume. There was no correlation between SVL and the number of prey (tau_b = -0.017, P = 0.450). However, the number of prey and prey volume were positively related. Since *P. bedriagae* finds more food, the stomach volume increases in correlation with the prey number.

Discussion

According to the results of the present study, the average prey number of *P. bedriagae* individuals was 4.27. Similarly, a study done by Fathinia et al. (2016) reported that the average number of preys for *P. ridibundus* individuals to be 4.35 while it was found 9.87 by Balint et al. (2010), 3.24 by Paunović et al. (2010) and 5.41 by Cicort-Lucaciu et al. (2013). Moreover, it was 3.44 in *P. lessonae* and 3.52 in *P. esculentus* (Paunović et al. 2010).

Table 2. Percentage rates of number, frequency and volume of preys based on sex in the diet of *Pelophylax bedriage*.

Prey category			♀♀	♂♂	♀♀	♂♂	♀♀	♂♂
Classis	Ordo	Familia	n%	n%	f%	f%	V%	V%
Insecta	Homoptera	Delphacidae	0.00	1.47	0.00	6.25	0.00	2.78
	Hymenoptera	Apidea	3.33	1.47	14.29	6.25	2.57	0.14
		Formicidae	3.33	17.65	7.14	31.25	0.98	3.02
		Vespidae	5.00	4.41	21.43	12.50	3.59	4.09
	Coleoptera	Cantharidae	0.00	1.47	0.00	6.25	0.00	0.29
		Carabidae	6.67	1.47	21.43	6.25	0.51	0.29
		Coccinellidae	0.00	2.94	0.00	12.50	0.00	0.11
		Elateridae	1.67	0.00	7.14	0.00	0.01	0.00
		Scarabaeidae	1.67	0.00	7.14	0.00	25.08	0.00
	Diptera	Culicidae	18.33	20.59	57.14	31.25	0.92	0.92
		Muscidae	10.00	5.88	14.29	18.75	0.22	0.25
	Hemiptera	Cicadellidae	0.00	1.47	0.00	6.25	0.00	9.50
		Gerridae	0.00	1.47	0.00	6.25	0.00	0.14
		Nabidae	1.67	0.00	7.14	0.00	0.03	0.00
	Ephemeroptera	Ephemerllidae	0.00	1.47	0.00	6.25	0.00	0.08
	Heteroptera	Pentatomidae	0.00	4.41	0.00	18.75	0.00	1.55
	Odonata	Aeshnidae	1.67	0.00	7.14	0.00	2.94	0.00
Arachnida	Araneae	Araneidae	8.33	7.35	14.29	31.25	18.86	1.09
		Agelenidae	0.00	2.94	0.00	12.50	0.00	0.54
		Philodromidae	1.67	0.00	7.14	0.00	4.21	0.00
Gastropoda	Basommatophora	Lymnaeidae	16.67	10.29	50.00	18.75	4.21	7.63
		Planorbidae	5.00	4.41	21.43	18.75	1.80	0.86
Malacostraca	Amphipoda	Gammaridae	15.00	1.47	42.86	6.25	17.98	0.46
	Isopoda	Oniscidae	0.00	1.47	0.00	6.25	0.00	0.29
		Sphaeromatidae	0.00	1.47	0.00	6.25	0.00	0.29
	Decapoda	Palaemonidae	0.00	1.47	0.00	6.25	0.00	12.53
Chilopoda	Scolopendromorpho	Scolopendridae	0.00	1.47	0.00	6.25	0.00	33.41
Clitellata	Lumbriculida	Lumbriculidae	0.00	1.47	0.00	6.25	0.00	2.08

We suggest that the average prey number per stomach was affected by the number and distribution of the species, season of the study, as well as the size of the population that the frogs were captured from. Since a single population was studied and individuals captured only in summer were used in the present study, as expected, average number of preys was lower (Kutrup et al. 2005).

Pesarakloo et al. (2017) identified 36 different prey groups in the stomach content of *P.ridibundus*. Paunović et al. (2010) found a total of 32 prey taxa in 3 *Pelophylax* species in which 26 of them were invertebrates. They also found that, in summer, the two main groups of prey were Coleoptera and Lepidoptera in *P. ridibundus*, Gastropoda and Coleoptera in *P. lessonae* and Coleoptera and Gastropoda in *P. esculentus*. Fathinia et al. (2016) found 23 invertebrate taxa in the diet of *P. ridibundus* and numerically the most abundant diet was composed of Diptera followed by Amphipoda. In addition, Pafilis et al. (2019) found that Coleoptera and Araneae are the most abundant and the most frequently consumed prey taxa by *P. cerigensis*. In this study, a total of 28 different prey was identified in *P. bedriagae* diet with Diptera being the highest in both number and frequency. It can be argued that the reasons of the variance of the number and main taxa of prey observed in different studies are related to the number of samples collected and the habitat conditions when the studies were realized.

There are a number of reports indicating that many species in the Ranidae family feed without selectivity. In the case of *P. ridibundus*, it has been shown that it does not have any specific food preference indicating a trophic opportunism (Parker & Goldstein 2004, Çiçek & Mermer 2006, Paunović et al. 2010). In line with previous findings in *Pelophylax* genus as well as other anurans, our results reported that *P. bedriagae* feeds without showing selectivity and environmental availability dominates the diet composition (López et al. 2009).

Contents like sand, wood, minerals and plants/seeds have been found in anuran stomachs (e.g., López et al. 2009, Cicort-Lucaciu et al. 2013, Fathinia et al. 2016). Das (1996) reported that the energy required for *Rana hexadactyla* was provided from plant materials. Additionally, Anderson et al. (1999) argued that plant consumption might be beneficial against parasites.

Plant remains were found in the stomach of *P. ridibundus*, *P. lessonae* and *P. esculentus* (Balint et al. 2010, Paunović et al. 2010). In *P. bedriagae* 18.75% of the stomachs were found to have vegetative materials and stone fragments. These items were not included in the calculations since they were swallowed by the frogs accidentally (Hirai & Matsui 1999, Pough et al. 2001, Mahan & Johnson 2007).

In the stomach contents of *P. bedriagae*, no vertebrate species were observed. However, in other studies, vertebrates such as lizards, fish, small mammals, frogs and salamanders have been reported (Sas et al. 2009, Nicolaou et al. 2014).

Specifically, in genus *Pelophylax*, unidentified Actinopterygii parts (Fathinia et al. 2016), amphibian *Lissotriton vulgaris* (Balint et al. 2010) and *Triturus* sp. (Ferenti et al. 2009), reptilian *Podarcis tauricus*, mammalian *Mus* sp. (Mollov et al. 2010) and other unidentified vertebrate parts were reported (e.g., Paunović et al. 2010, Pafilis et al. 2019). Additionally, cannibalism is reported for some Marsh frog species (Mollov 2008, Mollov et al. 2010, Cicort-Lucaciu et al. 2013) but not in the present study. Hirai & Matsui (2000) reported that there was no difference between sexes in terms of the number of consumed prey.

Mollov (2008) found that even though males had a broader trophic niche, the frequency of the most important prey categories and numeric proportion of prey taxa were indistinguishable between sexes. In the present study, no significant difference was found between sexes in terms of consumed food amount, which supports results from previous studies. However, significant difference in total volume between male and female individuals, could be an indication of sexual dimorphism in *P. bedriagae* in which females are larger and heavier than males (Başkale et al. 2018).

Several studies on amphibian feeding report pest species in their diet, suggesting that this group contributes to biological control of insects (Pough et al. 2001, Çiçek & Mermer 2006).

Some insect species recorded in the trophic contents in this study belong to Pentatomidae, Apidae and Scarabaeidae families, that are harmful to agriculture. By consuming preys that are considered agricultural pests, the frogs provide a reduction or stabilization of the insect populations in agricultural areas. This is also valid for some species potentially dangerous for endothermic vertebrates and especially for humans, such as Culicidae and Muscidae families. These results show that *P. bedriagae*'s ecological niche and importance in ecological balance is worthy of further research.

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References

AmphibiaWeb. (2021) <https://amphibiaweb.org> University of California, Berkeley, CA, USA. Accessed 21 Apr 2021

Anderson, A., Haukos, D., Anderson, J. (1999): Diet composition of three Anurans from the Playa Wetlands of Northwest Texas. Copeia 1999 (2): 515-520.

Atatür, M.K., Arıkan, H., Mermer, A. (1993): A preliminary study on the feeding biology of a *Rana ridibunda* (Anura, Ranidae) population from Beyşehir Lake. Turkish Journal of Zoology 17: 127-131.

Balint, N., Indrei, C., Ianc, R., Ursuţ, A. (2010): On the diet of the *Pelophylax ridibundus* (Anura, Ranidae) in Ţicleni, Romania. South Western Journal of Horticulture, Biology and Environment 1: 57-66.

Başkale, E., Ulubeli, S.A., Kaska, Y. (2018): Age structures and growth parameters of the Levantine frog, *Pelophylax bedriagae*, at different localities in Denizli, Turkey. Acta Herpetologica 13(2): 147-154.

Başoğlu, M., Özeti, N., Yılmaz, İ. (1994): Türkiye Amfibileri (The Amphibians of Turkey). Genişletilmiş 2. Baskı (Expanded 2nd edition). Ege Üniversitesi Fen Fakültesi Kitaplar Serisi, No. 151. Ege Üniversitesi Basımevi, Bornova, İzmir.

Camera, B.F., Krinski, D., Calvo, I.A. (2014): Diet of the Neotropical frog *Leptodactylus mystaceus* (Anura: Leptodactylidae). Herpetology Notes 7: 31-36.

Cicort-Lucaciu, A.S., Pelle, C., Borma, I.T. (2013): Note on the food composition of a *Pelophylax ridibundus* (Amphibia) population from the Dubova locality region, south-western Romania. Biharean Biologist 7(1): 33-36.

Çiçek, K., Mermer, A. (2006): Feeding biology of the marsh frog, *Rana ridibunda* Pallas 1771, (Anura, Ranidae) in Turkey's Lake District. North-Western Journal of Zoology 2(2): 57-72.

Çiçek, K., Mermer, A. (2007): Food composition of the Marsh Frog *Rana ridibunda* Pallas 1771 in Thrace. Turkish Journal of Zoology 31: 83-90.

Çiçek, K. (2011): Food composition of Uludag frog, *Rana macrocnemis* Boulenger, 1885 in Uludag (Bursa, Turkey). Acta Herpetologica 6: 87-99.

Das, I. (1996): Folivory and seasonal changes in diet in *Rana hexadactyla* (Anura: Ranidae). Journal of Zoology 238 (4): 785-794.

Dunham, A.E. (1983): Realized niche overlap, resource abundance, and intensity of interspecific competition. pp. 261-280. In: Huey, R.B., Pianka, E.R., Schoener, T.W. (eds.), Lizard ecology: Studies of a model organism, Harvard Univ. Press, Cambridge, MA.

Duellman, W.E., Trueb, L. (1986): Biology of amphibians. McGraw-Hill, New York.

Fathinia, B., Rastegar-Pouyani, N., Darvishnia, H., Shafaeipour, A., Jaafari, G. (2016): On the trophic spectrum of *Pelophylax ridibundus* (Pallas, 1771) (Amphibia: Anura: Ranidae) in western Iran. Zoology in the Middle East 62 (3): 247-254.

Ferenti, S., Covaciu-Marcov, S.D., Blaga-Lungulescu, RM (2009): The comparative analysis of the trophic spectrum of some populations of *Pelophylax ridibundus* and *Pelophylax* kl. *esculentus* from Arad County, Romania. Herpetologica Romanica 3: 31-39.

Gunzburger, M.S. (1999): Diet of the red hills salamander *Phaeognathus hubrichti*. Copeia 1999 (2): 523-552.

Halliday, T.R. (2008): Why amphibians are important. International Zoo Yearbook 42 (1): 7-14.

Hart, R.K., Calver, M.C., Dickman, C.R. (2002): The index of relative importance: an alternative approach to reducing bias in descriptive studies of animal diets. Wildlife Research 29 (5): 415-421.

Hirai, T., Matsui, M. (1999): Feeding habits of the Pond Frog, *Rana nigromaculata*, inhabiting rice fields in Kyoto, Japan. Copeia 1999 (4): 940-947.

Hirai, T., Matsui, M. (2000): Myrmecophagy in a Ranid Frog *Rana rugosa*: specialization or weak avoidance to ant eating. Zoological Science 17: 459-466.

Hirschfeld, M., Rödel, M.O. (2011): The diet of the African Tiger Frog, *Hoplobatrachus occipitalis*, in northern Benin. Salamandra 47 (3): 125-132.

Kutrup, B., Çakir, E., Yilmaz, N. (2005): Food of the banded newt, *Triturus vittatus* ophryticus (Berthold, 1846), at different sites in Trabzon. Turkish Journal of Zoology 29 (1): 83-89.

López, J.A., Scarabotti, P.A., Medrano, M.C., Ghirardi, R. (2009): Is the red spotted green frog *Hypsiboas punctatus* (Anura: Hylidae) selecting its preys?: The importance of prey availability. Revista de Biologia Tropical 57(3): 847-857.

Mahan, R.D., Johnson, J.R. (2007): Diet of the Gray Treefrog (*Hyla versicolor*) in relation to foraging site location. Journal of Herpetology 41(1): 16-23.

Mollov, I. (2008): Sex based differences in the trophic niche of *Pelophylax ridibundus* (Pallas, 1771) (Amphibia: Anura) from Bulgaria. Acta Zoologica Bulgarica 60 (3): 277-284.

Mollov, I., Boyadzhiev, P., Donev, A. (2010): Trophic role of the Marsh Frog *Pelophylax ridibundus* (Pallas, 1771) (Amphibia, Anura) in the aquatic ecosystems. Bulgarian Journal of Agricultural Science 16: 298-306.

Nicolaou, H., Zogaris, S., Pafilis, P. (2014): Frog vs. lizard: an unusual feeding behavior in the Levantine Marsh Frog, *Pelophylax bedriagae* from Cyprus. Amphibia-Reptilia 22: 1-19.

Pafilis, P., Kapsalas, G., Lymberakis, P., Protopappas, D., Sotiropoulos, K. (2019): Diet composition of the Karpathos marsh frog (*Pelophylax cerigensis*): What does the most endangered frog in Europe eat? Animal Biodiversity and Conservation 42 (1): 1–8.

Parker, M.L., Goldstein, M.I. (2004): Diet of the Rio Grande leopard frog (*Rana berlandieri*) in Texas. Journal of Herpetology 38(1): 127-131.

Paunović, A., Bjelić-Čabrilo, O., Šimić, S. (2010): The diet of water frogs (*Pelophylax esculentus*' complex') from the Petrovaradinski Rit marsh (Serbia). Archives of Biological Sciences 62(3): 797-806.

Pesarakloo, A., Rastegar-Pouyani, N., Rastegar-Pouyani, E., Najibzadeh, M., Shakarami, J., Kami, H.G., Shayestehfar, A. (2017): Feeding biology and food composition in *Pelophylax ridibundus* (Pallas 1771) in the iranian plateau. Russian Journal of Herpetology 24 (2): 91-98.

Pough, F.H., Andrews, R.M., Cadle, J.E., Crump, M.L., Savitzky, A.H., Wells, K.D. (2001): Herpetology, Prentice Hall Inc. New Jersey 228: 259-344.

Sas, I., Covaciu-Marcov, S.D., Strugariu, A., David, A., Ilea, C. (2009): Food habit of *Rana (Pelophylax)* kl. *esculenta* females in a new recorded E-system population from a forested habitat in North-Western Romania. Turkish Journal of Zoology 33(1): 1-5.

Sugai, J.L.M.M., Terra, J.D.S., Ferreira, V.L. (2012): Diet of *Leptodactylus fuscus* (Amphibia: Anura: Leptodactylidae) in the Pantanal of Miranda river, Brazil.

Biota Neotropica 12 (1): 99-104.
Yiyit, S., Tosunoğlu, M., Arıkan, H. (1999): Feeding biology in *Bufo viridis* (Anura: Bufonidae) populations of the vicinity of İzmir. Turkish Journal of Zoology 23: 279-288.
Zar, J.H. (2009): Biostatistical Analysis, 5th ed. Prentice Hall/Pearson, Upper Saddle River, NJ.