Short communication

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Data on the Food Composition of European Glass Lizard, *Pseudopus apodus* (Pallas, 1775) (Squamata: Anguidae) from Çanakkale (Western Anatolia, Turkey)

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Abstract: We examined the food composition of the European Glass Lizard, *Pseudopus apodus,* from Çanakkale (Western Anatolia, Turkey), by means of the stomach content analysis. Some 72 prey items with sizes ranging from 10 to 60 mm were detected in the stomach contents of the 13 (7 ♂♂, 6 ♀♀) museum specimens under examination. The median number of prey items was 5 (range = 3–8) in males and 4 (4–6) in females. According to the obtained data, the class Insecta (86.1%) is the predominant food of the species, with the most frequently observed prey items belonging to the order Coleoptera (76.4%). Orthoptera (4.2%), Hemiptera (5.6%), Gastropoda (8.3%), and Isopoda (5.6%) are the other prey groups observed in the food contents. Even though no difference in food contents was observed between the sexes, the food niche breadth of females was higher. In conclusion, the main food of *P. apodus* consists of non-flying or weak-flying insects as well as other invertebrates.

Key words: Food analysis, European Glass Lizard, *Pseudopus apodus*, Western Anatolia, Turkey

Introduction

The European Glass Lizard, *Pseudopus apodus* (Pallas, 1775), ranges from the Balkan Peninsula to Anatolia, the Caucasus, Central Asia, and the Middle East (Anderson 1999, Annajeva *et al.* 2006). The species is partially distributed in Turkey and known from the Thracian, Western Anatolian, Central Black Sea, Eastern Mediterranean, and Eastern Anatolian regions (Başoğlu, Baran 1977). The European Glass Lizard is listed in Appendix II of the Bern Convention and it is in the least concern category in the Red List of European reptiles because of its habitat loss and degradation (Cox, Temple 2009).

The European Glass Lizard inhabits dry and well-vegetated rocky slopes, maquis, traditionally cultivated areas, and areas close to human settlements (Başoğlu, Baran 1977, IUCN 2004). Despite the presence of various studies on the taxonomy of the species (*e. g*., Öz 1982, Baran 1977, Baran *et al.* 1988, Keskin *et al.* 2013), the information on its biology (*e. g.,* Meek 1986a, 1986b) is still limited. In this study, the food contents of the *Pseudopus apodus* population, which inhabits the vicinity of Çanakkale, were examined and information on the food composition of the species was provided.

Material and Methods

We examined 13 (7 ♂♂, 6 ♀♀) preserved specimens of *P. apodus* collected between 2002 and 2009. The specimens were obtained in order to examine the morphology and phylogeny of the species then stored in the Museum of the Faculty of Arts and Sciences, Çanakkale Onsekiz Mart University, and incorporated into the collection of ZDEU-ÇOMU

(Zoology Department, Ege University – Çanakkale Onsekiz Mart University), Turkey. In all individuals, we measured the snout-vent length (hereinafter 'the SVL') and the total length ('the TL') with a dial caliper to the nearest 0.01 mm. The stomachs were dissected, and prey items were identified under a stereomicroscope to the lowest possible taxa.

The food contents were assessed in terms of the numeric proportion [the number of a particular prey item in all prey items, N%], the frequency of occurrence [the frequency of lizard stomachs containing a particular prey type, F%], and the volumetric proportion [the volume of a particular prey item in all prey items, V%]. The prey volume was calculated using the ellipsoid formula (Dunham 1983): $V= 4/3\pi (L/2) (W/2)^2$ [V: prey volume; L: length of prey; W: width of prey]. The sexes were compared by means of the t-test, and Mann-Whitney U tests were performed using the PAST statistical program (Hammer *et al*. 2001). The alpha level was set at 0.05. The mean values were provided with their standard deviations.

Results

The mean SVL was 365.7 mm (SD=23.34, range=320-390 mm) in males and 374.4 mm (SD=54.86, range=250-379 mm) in females. The mean TLs were measured as 923.7 mm (SD=45.68, range=844-983 mm) and 895.2 mm (SD=100.00, range=730-1002 mm) in males and females, respectively. There were no statistical differences in the SVL (t test=0.959, P≤0.422) or the TL (t test=0.672, P≤0.567) between the sexes.

In the stomach contents of 13 specimens, 72 prey items (37 in males, and 35 in females) were detected, with their sizes varying between 10 and 60 mm. The median number of prey items was 5 (3–8) in males, and 4 (4-6) in females. No statistical difference in the number of prey items in the stomach contents was present between the sexes (Mann-Whitney U test=11.00, P≤0.308).

A total of 72 prey items in the stomach contents of *P. apodus* were found to belong to 3 classes and 5 orders (Table 1). The prey taxa included classes Insecta (Orthoptera, Hemiptera and Coleoptera), Gastropoda (Pulmonata) and Malacostraca (Isopoda). When compared with other classes, the Insecta contained the highest number of prey groups (N%=86.1%). Among these prey items, the largest group by numeric proportion (N%) and frequency of occurrence (F%) in the stomach contents was the order Coleoptera (76.4%, 84.6%). The most frequently observed prey families in the food contents were Carabidae (F%-69.2%), Cerambycidae (53.8%) and Helicidae (23.1%). Furthermore, the most consumed prey items belonged to the families Carabidae (N%= 37.5%), Cerambycidae (25%), and Tenebrionidae (13.9%).

Discussion

The results of the study showed that the food contents in the Çanakkale population of the European Glass Lizard consist largely of weak-flying or flightless terrestrial invertebrates. Class Insecta and particularly Coleoptera are the most consumed prey items among the prey groups. The more active and well-flying prey items from the groups Hemiptera and Orthoptera are encountered in a smaller number. The other prey items are gastropods, mollusks and isopods. Other authors also reported that the food of the species generally consists of various terrestrial invertebrates, such as snails, slugs, beetles and grasshoppers, and occasionally, of fledgling birds, lizards, small rodents, and eggs of birds and reptiles (Terentev, Chernov 1965, Başoğlu, Baran 1977, Anderson 1999, Rifai *et al.* 2005).

Terentev, Chernov (1965) reported that the basic food of the species in the Caucasus is the prey items included in the groups Mollusca (slugs in particular), Coleoptera (Geotrupidae, Tenebrionidae, and Buprestidae) and Orthoptera (Acrididae), and that large individuals also consume large prey items, such as rodents and lizards. In the field observations, the species was also found to eat rodents (*Cricetulus migratorius*) (Stoev 2000).

In the Caucasus, the food composition of *P. apodus* consists mainly of insects (98.1%), especially coleopterans (Tenebrionidae, Carabidae, Scarabaeidae and Curculionidae), orthopterans (Acrididae and Tettigoniidae), and lepidopteran larvae (Sphingidae). Other preys are mollusks (27%) and vertebrates (17.3%; *Crocidura suaveolens*, *Lacerta* sp. and *Eremias* sp.) (Syrojeckowsku 1958, Petzold 1971). These authors also stated that some cicadas, hymenopterans, spiders, isopods and snakes (*Eryx jaculus*) are found in the food contents. In the Crimean population, the food composition consists of mollusks (60.7%), isopods (28.6%), Lepidopteran larvae (14.2%), Cerambycidae (7.3%), Scarabaeidae (7.3%) and cicadas (Scerbak 1966).

Rifai *et al*. (2005) reported the food contents of seven *P. apodus* specimens from Jordan and indicated that arthropods (mostly orthopterans, 55.8%) and mollusks constitute the highest number of preys consumed. The other prey groups in the Jordanian specimens are Coleoptera (19.1%), Pulmonata

Table 1. Food composition of 13 (7 ♂♂, 6 ♀♀) individuals of *P. apodus* from Çanakkale. F %: frequency of occurrence, N %: numeric proportion, V %: volumetric proportion. (72 preys from 13 stomachs, total volume 9475.4 mm^3)

Prey Taxa	Males			Females			Total		
	F (%)	N (%)	V (%)	F (%)	N (%)	V (%)	F (%)	N (%)	V (%)
Insecta	6 (85.7)	33 (45.8)	4453.4 (83.3)	6 (100)	29 (82.9)	3374.9 (81.7)	12 (92.3)	62 (86.1)	7921.8 (83.6)
Orthoptera	-	-	-	1 (16.7)	3 (8.6)	134.7 (3.3)	1 (7.7)	3 (4.2)	134.7 (1.4)
Tettigoniidae	-	-	-	1 (16.7)	3 (8.6)	134.7 (3.3)	1 (7.7)	3 (4.2)	134.7 (1.4)
Hemiptera	1 (14.3)	1 (1.4)	93.5 (1.7)	1 (16.7)	3 (8.6)	494.0 (12.0)	2 (15.4)	4 (5.6)	587.4 (6.2)
Cicadidae	1 (14.3)	1 (1.4)	93.5 (1.7)	1 (16.7)	3 (8.6)	494.0 (12.0)	2 (15.4)	4 (5.6)	587.4 (6.2)
Coleoptera	6 (85.7)	32 (44.4)	4453.4 (83.3)	5 (83.3)	23 (65.7)	2746.2 (66.5)	11 (84.6)	55 (76.4)	7199.7 (76.0)
Carabidae	6 (85.7)	20 (27.8)	3044.7 (57.0)	3 (50.0)	7 (20.0)	618.7 (15.0)	9 (69.2)	27 (37.5)	3663.4 (38.7)
Calosoma sp.	1 (14.3)	3 (4.2)	586.9 (11.0)	-	-	-	1 (7.7)	3 (4.2)	586.9 (6.2)
Carabus sp.	1 (14.3)	4 (5.6)	1064.0 (19.9)	-	-	-	1 (7.7)	4 (5.6)	1064.0 (11.2)
Cerambycidae	3 (42.9)	6 (8.3)	1294.1 (24.2)	4 (66.7)	12 (34.3)	1830.1 (44.3)	7 (53.8)	18 (25.0)	3124.2 (33.0)
Tenebrionidae	1 (14.3)	6 (8.3)	114.6 (2.1)	1 (16.7)	4 (11.4)	297.4 (7.2)	2 (15.4)	10 (13.9)	412.1 (4.3)
Gastropoda	2 (28.6)	4 (5.6)	798.1 (14.9)	2 (33.3)	2 (5.7)	682.5 (16.5)	4 (30.8)	6 (8.3)	1480.6 (15.6)
Pulmonata	2 (28.6)	4 (5.6)	798.1 (14.9)	2 (33.3)	2 (5.7)	682.5 (16.5)	4 (30.8)	6 (8.3)	1480.6 (15.6)
Helicidae	1 (14.3)	3 (4.2)	195.0 (3.6)	2 (33.3)	2 (5.7)	682.5 (16.5)	3 (23.1)	5 (6.9)	877.5 (9.3)
Helix sp.	1 (14.3)	3 (4.2)	195.0 (3.6)	2 (33.3)	2 (5.7)	682.5 (16.5)	3 (23.1)	5 (6.9)	877.5 (9.3)
Limacidae	1 (14.3)	1 (1.4)	603.2 (11.3)	-	-	-	1 (7.7)	1 (1.4)	603.2 (6.4)
Limax sp.	1 (14.3)	1 (1.4)	603.2 (11.3)	-	-	-	1 (7.7)	1 (1.4)	603.2 (6.4)
Malacostraca	-	-	-	1 (16.7)	4 (11.4)	73.0 (1.8)	1 (7.7)	4 (5.6)	73.0 (0.8)
Isopoda	-	-	-	1 (16.7)	4 (11.4)	73.0 (1.8)	1 (7.7)	4 (5.6)	73.0 (0.8)
Oniscidae	-	-	-	1 (16.7)	4 (11.4)	73.0 (1.8)	1 (7.7)	4 (5.6)	73.0 (0.8)
Oniscus sp.	-	-	-	1 (16.7)	4 (11.4)	73.0 (1.8)	1 (7.7)	4 (5.6)	73.0 (0.8)

(5.3%), Blattaria (10.6%), Lepidopteran larvae (2%), Hymenoptera (0.6%) and Isopoda (0.6%). The authors indicated that there are no differences in the diet either between sexes or among the age groups.

The basic food of another anguid, *Ophisaurus attenuates*, consists of insects, other invertebrates, and occasionally vertebrates, such as young mice and ground-nesting birds (Vogt 1981). The food contents of *Anguis fragilis,* included in the same family, are composed of mollusks, earthworms, millipedes, amphibians, insects and their larvae (Terentev, Chernov 1965, Luiselli *et al.* 1994, Pedersen *et al.* 2009, Mollov 2010). In the other anguid lizard species, no difference in food composition between the sexes was observed (Pedersen *et al.* 2009, Mollov 2010).

Widely-foraging predators encounter and consume non-moving types of prey more frequently (Pianka 1966). Perry, Pianka (1997) stated that external, internal and evolutionary factors have a role in the determination of the hunting behavior. According to these authors, the widely-foraging predators catch their prey by using their senses of sight and smell, and their food-niche breadth is narrow. Fitch (1989) reported that Glass lizards primarily hunt by using their sense of smell and use their olfactory organ to detect the location of prey. When the limited food contents of *P. apodus* and its consumption of less active prey items are considered, it can be included in the group of predators which use the widely-foraging tactic.

None of the stomachs examined was empty and that the number of prey items was substantial. Huey *et al.* (2001) claimed that diurnal lizards as *P. apodus* are in positive energy balance and generally have food in their stomachs.

In conclusion, the food composition of the European Glass Lizard, *P. apodus,* from the vicinity of Çanakkale consists particularly of slowly-moving prey items, mostly Coleoptera (Carabidae, Cerambycidae, and Tenebrionidae). At the same time, the active and well-flying prey items of Orthoptera and Hemiptera were observed to be in smaller amounts in the food contents. Among the other invertebrate prey items are gastropods and isopods. The species is a generalist and widely-foraging predator, which feeds on slowly-moving insects.

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