Acta Herpetologica 8(2): 167-170, 2013

Food composition of Ocellated Skink, *Chalcides ocellatus* (Forskal, 1775) (Squamata: Scincidae), from the Cyprus Island

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Submitted on 2013, 10th October; revised on 2013, 2nd December; accepted on 2013, 6th December.

Abstract. We examined the food composition of the museum specimens of *Chalcides ocellatus* (Forskal, 1775) collected from Morphou (= Güzelyurt) and Gönyeli (Nicosia District, Northern Cyprus). The stomach contents of 41 (23 males, 11 females, and 7 juveniles) individuals were analyzed, and totally 86 prey items were detected. The species was found to feed mainly on a variety of insects (94.3%) and particularly on coleopterans (62.1%). No statistically significant sex- or age-dependent difference was observed in the feeding regime. In conclusion, the diet of *C.ocellatus* was based mainly on insects and other arthropods.

Keywords. *Chalcides ocellatus*, Ocellated skink, food analysis, Cyprus

The Ocellated Skink, *Chalcides ocellatus* (Forskal, 1775), is a medium-sized semi-fossorial lizard which is mainly distributed from North Africa, the Middle East, and the most part of the Mediterranean basin (Anderson, 1999; Kornilios et al., 2010; Uetz and Hošek, 2013). The species occupies a wide range of habitats such as archaeological sites, cultivated fields, hedges, gardens, open forest, Mediterranean scrub, and patches of vegetation on coastal sands (Schleich et al., 1996; Anderson, 1999; Kalboussi and Nouira, 2004; Budak and Göçmen, 2005; Baha Eldin, 2006; Taylor et al., 2012).

Chalcides ocellatus is a predominantly insectivorous lizard which feeds on various terrestrial insects. Data on the food composition of *C. ocellatus* were investigated in Turkey (Mermer, 1996), Tunisia (Kalboussi and Nouira, 2004), Egypt (Attum et al., 2004; Taylor et al., 2012), and Italy (Capula and Luiselli, 1994; Rugiero, 1997; Lo Cascio et al., 2008; Carretero et al., 2010). Only anecdotal data on the food composition of the species from Northern Cyprus are available. The present study aims to determine the food composition of the Northern Cypriot population and to contribute to the limited knowledge of its biology.

We examined 41 (23 males, 11 females, and 7 juveniles) preserved specimens of *C. ocellatus* deposited at the ZMHRU (The Zoology Museum of Harran University, Şanlıurfa, Turkey). They were used to determine the Northern Cypriot Herpetofauna as a continuation of the previous study (Göçmen et al., 2008). Lizards were collected from Morphou (= Güzelyurt, lat.: 35.209389°, long.: 32.954021°, sea level) and Gönyeli (lat.: 35.238192°, long.: 33.299273°, 178m asl.), Nicosia district, Northern Cyprus on July 2 and 3, 2008.

For all individuals, we measured the snout-vent length (hereinafter 'the SVL') with a dial caliper to the nearest 0.01 mm. Sex was determined by direct observation of the gonads during dissection. According to the gonad development, we considered those with a SVL less than 55 mm juveniles. The stomachs were dissected, and prey items were identified under a stereomicroscope. We identified the stomach contents 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%) and the frequency of occurrence (the frequency of lizard stomachs containing a particular prey type, F%). The trophic niche overlap was

ISSN 1827-9635 (print)
ISSN 1827-9643 (online)

measured using Pianka's index (O, 1973). This index ranges from 0 (no similarity) to 1 (totally similar). The food-niche breadth was determined using Shannon's index (H, Shannon, 1948). The values of this index typically range from 1.5 (narrow niche breadth) to 3.5 (wide niche breadth) (MacDonald, 2003). All niche calculations were done by making use of the "EcoSim Version 7.72" program (Gotelli and Entsminger, 2012). Normality of the SVL and TL distributions for both males and females was tested with Kolmogorov-Smirnov D test, and since they were normally distributed ($P \geq 0.05$), the parametric t-test was used for comparison. The age classes (juveniles, males, and females) were compared using the non-parametric Kendall's rank correlation and Kruskal-Wallis tests due to the data which were not normally distributed (the Kolmogorov–Smirnov D test, $P \leq 0.05$). The alpha level was set at 0.05. In the Results section, the mean values are provided with their standard deviations.

The average SVL of the 41 (23 males, 11 females, and 7 juveniles) individuals of *C. ocellatus* from Northern Cyprus under examination was 48.0 (SD = 3.75, range = 42.8–52.2) mm for juveniles, 71.9 (6.86, 55.0–83.2) mm for males, and 72.10 (5.46, 64.5–81.3) mm for females. There are no statistical differences in size between the sexes (t-test, $t = 0.107$, $P = 0.916$). In the stomach contents of 41 individuals, 86 prey items (9 in juveniles, 49 in males, and 28 in females) were detected, with their sizes varying between 3 and 20 mm, and the median number of prey items was 1 (range = 1–3) in juveniles, 2 (1–6) in males, and 1 (1–6) in females. A rather weak correlation was observed between the SVL and the number of prey items (Kendall $\tau = 0.31$, $P = 0.02$). No statistical difference in the number of prey items in the stomach contents was present among males, females, and juveniles (Kruskal-Wallis test, $\chi^2 = 4.678$, $P = 0.096$).

A total of 86 prey items in the stomach contents of *C. ocellatus* were found to belong to 3 classes and 5 orders (Table 1). Sand and gravel materials were found in the stomach contents, and it is most likely that they were ingested accidentally during foraging. The prey taxa included classes Arachnida (Araneae), Chilopoda (Geophilomorpha), and Insecta (Orthoptera, Hymenoptera, Coleoptera, and Lepidoptera). When compared with other classes, Insecta contains the highest number of prey groups (94.3%). Among these prey items, the largest groups by numeric proportion (N%) found in the stomach contents were Coleoptera (62.1%), Orthoptera (13.8%), and Formicidae (8.1%), respectively. The largest rate by frequency of occurrence (F%) also belonged to these groups: Coleoptera (70.7%), Orthoptera (26.8%), and Formicidae (7.3%). However, only 2 (2.4%) larval prey items were consumed by lizards. As it is seen, order Coleoptera is the favorite prey taxon in the sexes.

According to the Pianka's niche overlap index (O), the food composition of males, females and juveniles is mostly similar ($O_{juveniles,\ males} = 0.87$, $O_{juveniles,\ females} = 0.91$, and $O_{males}, O_{females} = 0.93$), and the food contents considerably overlapped. This means that adults and juveniles use the same microhabitat for foraging. Additionally, the close food-niche breadth (Shannon's index, H) was observed in the age classes ($H_{juveniles} = 1.53$, $H_{males} = 1.40$, and $H_{females} = 1.79$). According to the index values, the Cypriot population has a narrow food-niche breadth.

Although the food composition of *C. ocellatus* quite varies according to the region it inhabits, it generally feeds mainly on various arthropods and predominantly on the prey items included in class Insecta. The most preferred prey items in the food composition of the Tunisian population are Coleoptera (N% = 56.1%, F% = 84.3% for the northern population; 7.1%, 22.9% for the southern population), Isopoda (38.6%, 40% for the southern population) and insect larvae (12.4%, 45.7% for the northern population; 19.3%, 34.3% for the southern population) (Kalboussi and Nouira, 2004). Capula and Luiselli (1994) stated that Isopoda (N% = 16.7%), Gastropoda (16.7%), Oligochaeta (14.6%), and Araneae (11.4%) were the most frequently consumed prey items for the Central Sardinian (Italy) population. An insular (Lampione, Italy) population was examined, and its food composition was observed to consist substantially of Coleoptera (N% = 18.3%, F% = 66.7%) and insect larvae (8.5%, 30.3%) (Carretero et al., 2010). These authors also stated that the species partially consumed plant material (N% = 60.8%, F% = 75.8%) as well. Rugiero (1997) detected (N%) 42.4% Araneae, 15.1% Isopoda, and 15.1% Coleopteran larvae in the food composition of the Central Italian population. Lo Cascio et al. (2008) stated that Lampedusa and Conigli (the Pelagie Islands, Italy) populations of *C. ocellatus* primarily fed on arthropods and that the main prey items for the individuals were Heteroptera (N% = 32.1%), Coleoptera (21.1%), Gastropoda (11.9%), and Formicidae (10.0%) for Lampedusa and Coleoptera (38.0%), Formicidae (12.0%), and insect larvae (16.0%) for Conigli. Attum et al. (2004) reported that Coleoptera and Hymenoptera were the most observed prey items in the food composition of the species from the Sinai Peninsula (Egypt). The favorite prey item groups in the southern Egyptian population are insect larvae (N% = 37%, F% = 40%), and it was detected to feed on Orthoptera (20%, 23%), Coleoptera (20%, 13%), and plant material (14%, 13%) (Taylor et al., 2012). The food composition of *C. parallelus* generally consisted of Coleoptera (N% = 54.8%), Blattodea (12.3%), Araneae (6.8%), and Gastropoda (5.5%) from the Chafarinas Islands in North

Table 1. Food composition of *Chalcides ocellatus* (7 juveniles, 23 males, and 11 females) from Northern Cyprus. n (%): prey numbers and their proportion in the lizard stomach, F (%): frequency of occurrence of the prey item in the stomach of all individuals.

Prey Taxa	Juveniles n (%)	Males n (%)	Females n (%)	Total n (%)	**F (%)**
Chilopoda					
Geophilomorpha	-	1 (2%)	1 (3.6%))	2 (2.3%)	1 (2.4%)
Arachnida		-			
Araneae	1 (11.1%)	-	1 (3.6%)	2 (2.3%)	2 (4.9%)
Insecta					
Undetermined Insects	2 (22.2%)	5 (10.0%)	-	7 (8.1%)	3 (7.3%)
Orthoptera	2 (22.2%)	8 (16.0%)	2 (7.1%)	12 (13.8%)	11 (26.8%)
Hymenoptera					
non-Formicidae	-	-	1 (3.6%)	1 (1.1%)	1 (2.4%)
Formicidae	2 (22.2%)	-	5 (17.9%)	7 (8.1%)	3 (7.3%)
Coleoptera					
Undetermined Coleopterans	-	-	2 (7.1%)	2 (2.3%)	1 (2.4%)
Coleoprean larvae	-	-	2 (7.1%)	2 (2.3%)	1 (2.4%)
Carabidae	2 (22.2%)	32 (64%)	7 (25%)	41 (47.1%)	22 (53.7%)
Cerambycidae	-	-	1 (3.6%)	1 (1.1%)	1 (2.4%)
Coccinellidae	-	1 (2.0%)	1 (3.6%)	2 (2.3%)	1 (2.4%)
Tenebrionidae	-	1 (2.0%)	5 (17.9%)	6 (6.9%)	4 (9.8%)
Lepidoptera	-	1 (2.0%)	-	1 (1.1%)	1 (2.4%)
Number of prey items	9	49	28	86	
H	1.53	1.40	1.79		

Africa (Civantos et al., 2013). Mermer (1996) stated that Coleoptera (N% = 83.3%), Formicidae (40%) and Gastropoda (33.3%) were the most encountered groups in the food composition of the Turkish population. Coleoptera, Orthoptera and Formicidae were substantially observed in the food composition of the Northern Cypriot population, respectively.

We observed a few seeds in the stomach contents of a female individual. In the Ocellated skink, plant material was observed in the food composition of insular populations (Lo Cacsio et al., 2008; Carretero et al., 2010), whereas no or a low proportion of plant remains were found in the food of continental populations (e.g. Kalboussi and Nouira, 2004; Civantos et al., 2013). Carretero et al. (2010) claimed that there was a trend for increasing the degree of plant consumption with isolation and for decreasing it with the island area. When compared to other conspecific populations, partly herbivory feeding of *C.ocellatus* could be related to limited food sources in island populations.

Skink lizards are positive energy balance (Huey et al., 2001) and generally have food in their stomachs. We detected that the individuals of Cypriot population had at least one prey item in their stomach. Capula and Luiselli (1994) observed a positive correlation between the SVL and the number of prey items. There was a quite weak relationship in the Cypriot population, and the food composition did not fully overlap between the sexes in the southern Egyptian population of the species (O = 0.61), and it was indicated that its reason might be related to the small number of specimens (Taylor et al., 2012). The niche overlap we observed among the age groups in the Cypriot population reinforces this probability.

In conclusion, the Ocellated Skinks (*C.ocellatus*) mainly fed on arthropods and especially on terrestrial insects. There were no differences in diet between the sexes and among the age groups. The most frequently consumed prey items with respect to numeric proportion were Coleoptera, Orthoptera, and Formicidae. Other prey groups were Chilopoda and Araneae. The food composition of *C.ocellatus* was based mainly on insects and other arthropods and Carabids constituted nearly half of its food.

ACKNOWLEDGEMENTS

The collection of specimens was permitted by the Environmental Protection Agency in the Ministry of Environment and Natural Resources of the Turkish Republic of Northern Cyprus (Protocol No. Ç.K.0.00.23.89.7.07.1202 of November 13, 2007). Thanks are due to two anonymous reviewers for their constructive contribution.

REFERENCES

Anderson, S.C. (1999): The lizards of Iran. Society for the study of Amphibians and Reptiles, Ithaca, NY.

Attum, O., Covell, C., Eason, P. (2004): The comparative diet of three Saharan sand dune skinks. Afr. J. Herpetol. **53**: 91-94.

Baha Eldin, S.M. (2006): A guide to the Reptiles and Amphibians of Egypt. American University in Cairo Press, Cairo.

Budak, A., Göçmen, B. (2005): Herpetology. Ege Üniversitesi Fen Fakültesi Kitaplar Serisi, No. 194, Ege Üniversitesi Basimevi, Bornova-Izmir. [In Turkish]

Capula, M., Luiselli, L. (1994): Resource partitioning in a Mediterranean lizard community. Boll. Zool. **61**: 173-177.

Carretero, M.A., Cascio, P.L., Corti, C., Pasta, S. (2010): Sharing resources in a tiny Mediterranean island? Comparative diets of *Chalcides ocellatus* and *Podarcis filfolensis* in Lampione. Bonn Zool. Bull. **57**: 111-118.

Civantos, E., Ortega, J., López, P., Pérez-Cembranos, A., Pérez-Mellado, V., Martín, J. (2013): Diet selection by the threatened Chafarinas' skink *Chalcides parallelus* in North Africa. Afr. J. Herpetol. **2013**: 1-12.

Göçmen, B., Kaşot, N., Yıldız, M.Z., Sas, I., Akman, B., Yalçınkaya, D., Gücel, S. (2008): Results of the Herpetological Trips to Northern Cyprus. North-West J. Zool. **4**: 139-149.

Gotelli, N.J., Entsminger, G.L. (2012): EcoSim 7.72. Acquired Intelligence, Inc. http://www.uvm.edu/~ngotelli/EcoSim/EcoSim.html.

Huey, R.B., Pianka, E.R., Vitt, L.J. (2001): How often do lizards "run on empty"? Ecology **82**: 1-7.

Kalboussi, M., Nouira, S. (2004): Comparative diet of northern and southern Tunisian populations of *Chalcides ocellatus* (Forskal, 1775). Rev. Esp. Herp. **18**: 29-39.

Kornilios, P., Kyriazi, P., Poulakakis, N., Kumlutaş Y., Ilgaz, Ç. (2010): Phylogeography of the ocellated skink *Chalcides ocellatus* (Squamata: Scincidae), with the use of mtDNA sequences: a hitch-hiker's guide to the Mediterranean. Mol. Phylogenet. Evol. **54**: 445-456.

Lo Cascio, P., Corti, C., Carretero, M.A., Pasta, S. (2008): Dati preliminari sulla dieta di due popolazioni insulari di *Chalcides ocellatus*. Herpetologia Sardiniae **8**: 314-317.

MacDonald, G.M. (2003): Biogeography: Space, time, and life. John Wiley & Sons Inc., New York, USA.

Mermer, A. (1996): Biological and taxonomical investigations on *Chalcides ocellatus* (Sauria: Scincidae) in Anatolia. Turk. J. Zool. **20**: 77-93.

Pianka, E.R. (1973) The structure of lizard communities. Annu. Rev. Ecol. Evol. Syst. **4**: 53-74.

Rugiero, L. (1997): On the ecology and phenology of *Chalcides chalcides* (Linnaeus 1758) in central Italy (Squamata; Sauria; Scincidae). Herpetozoa **10**: 81-84.

Schleich, H.-H., Kästle, W., Kabisch, K. (1996): Amphibians and Reptiles of North Africa. Koeltz Scientific Publishers, Koenigstein, Germany.

Shannon, C.E. (1948): A mathematical theory of communication. Bell Syst. Tech. J. **27**: 379-423 and 623-656.

Taylor, D.J., Titus-Mcquillan, J., Bauer, A.M. (2012): Diet of *Chalcides ocellatus* (Squamata: Scincidae) from Southern Egypt. Bull. Peabody Mus. Nat. Hist. **53**: 383-88.

Uetz, P., Hošek, J. (2013): The Reptile Database http://www.reptile-database.org, accessed: Aug 1, 2013.